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Concentration in Water-Powers

At the conservation meeting in Washington this week figures were presented by Mr. Gifford Pinchot to show that concentration in ownership of water-powers is greater to-day than at the time of the last compilation on this subject under government auspices. Whether or not these figures are accurate they are of much less importance than some conservationists would have the public believe. The fact of the matter is that development of water-powers has made useful a large number of latent forces in the community which were doing no good to anybody. Undeveloped water-power made useful is an economic gain to the whole community. There must necessarily be also a monetary gain to those who advance the capital to create the enterprise and make it commercially successful. If no profits were likely, capital would not be forthcoming. If capital were not invested, the water-powers would remain undeveloped and conservation would be a fiasco. The largest possible use of energy generated by water-power means the largest possible measure of economy in coal. To the extent that the country prevents utilization of water-powers and delays the development of those mighty forces of industry, it depletes further the coal supply. If it encourages the greatest possible development of water-powers, it conserves the coal supply. The real issue is not whether one or ten large interests have made commercially successful many hydroelectric enterprises throughout the country, but what the effect of this has been, for good or harm, on the communities served. If those who propose to conserve the water-powers by leaving them to posterity for development will answer this question they will help and not hinder commercial progress.

Utilization Versus Waste of Water

A prominent example of the great economic mistake in allowing developed water-power to go to waste in a community where there is use for energy during light-load periods, and where steam plants are being operated to carry such light loads, is afforded by the hydroelectric installation of the Chicago Drainage Canal at Lockport. This plant supplies electric energy for the street lighting of Chicago to the extent of its permissible output during each night, but a large amount of energy goes to waste over the dam during daylight hours. At the same time, it appears that Chicago is about to be faced with a shortage of water-power for street-lighting purposes if electric street lighting is to be used over the whole city, because of the probable limit in the flow of the drainage canal. Leaving aside all petty politics, the obvious, sound, economic procedure in such a case is for the drainage canal plant to supply its cheap hydroelectric energy to the central-station systems of Chicago and surroundings during daylight hours and, in turn, to take the necessary surplus energy for operating the street-lighting system from the Chicago central-station systems at night. That such a plan might be opposed by cheap politicians on the one hand and by over-zealous and misinformed reformers on the other is probable, but the economic facts are as stated. The sooner the situation in Chicago and many similar situations can be straightened out along the lines indicated, the nearer will we be to true conservation of our natural resources.

Electric Machinery on Automobiles

An interesting trio of papers was presented last week before the American Institute of Electrical Engineers on the use of dynamo machines on automobiles. The first use of such machines was for ignition purposes. Next came small automobile generators for lighting the head-lamps, side-lamps, rear-lamps and inside lamps of the car, in conjunction with a storage battery. Later still came electric motors for starting the car engines by energy from the battery. It would manifestly be desirable to have one and the same small dynamo machine perform all of the three above-mentioned functions, not only on account of economy in first cost, but also on account of economy in space and weight carried. The difficulties in the way of such unification are, however, considerable owing to the fact that for lighting purposes the voltage delivered at the terminals of the ordinary lamp must be substantially constant, despite changes in the speed of the car. The result is that the electrical equipments thus far placed in service differ very widely in their details. Mr. Alexander Churchward, author of one of the papers, advocated a constant-speed generator coming into action at and above a car speed of, say, 8 miles per hour, with a slipping clutch such that at speeds above, say, 14 miles per hour the clutch will automatically permit of the right differential slip, so as to maintain constant generator speed. Such a plan would, of course, not be permissible if the generator had to supply a large amount of power, owing to the necessary low efficiency of the system at high car speeds. With the small amount of power actually demanded from the ordinary automobile generator, such slip-clutch, constant-speed generator-driving equipment becomes practicable and available until it can be superseded by an equipment equally effective and simple, but saving the energy lost in clutch-slip. The developments which have thus far taken place in automobile electric lighting are in many respects similar to those which formerly took place in the art of railroad-car electric lighting using axle-driven generators. The tendency there has been steadily toward simplification, but it must be remembered that while the railroad-car electric

equipment has to carry a much larger load than the automobile equipment, it is nevertheless freed from the demands for ignition and car starting.

Suppressing Arcs at Switch Contacts

The method of suppressing sparking at interruptor contacts by shunting them with a condenser is well known and has long been used in connection with Ruhmkorf coils. The method has recently been studied by Dr. W. Burstyn, and detailed improvements suggested by the research have recently been published in *Elektrotechnische Zeitschrift*. The oscillatory-current circuit has received much attention during the last few years, in relation to radio-telegraphy. It is interesting to see the knowledge gained in that way reapplied to the proposed use of condenser circuits as shunts to alternating-current switch contacts. A properly designed oscillatory circuit, of a condenser and non-ferric inductance, is shunted across the opening contacts of an alternating-current circuit switch. On opening, an oscillation is set up in the branch circuit. By designing the switch contacts like those of a radio-transmitter quenched-spark interruptor, the oscillations extinguish themselves without arcing.

Whether the quenched-spark air interruptor can be brought into effective competition with the oil switch, in common use on high-tension circuits, seems very doubtful. Nevertheless, the details of the plan suggested are interesting and possibly may find application to oil switches themselves. It is evident that as the various branches of electrical engineering develop they are able to come to each other's aid in cases of difficulty in a manner which is sometimes surprising. The designer of a high-tension switch may have to familiarize himself with radio-transmission phenomena in order to eliminate certain difficulties with high-frequency oscillations.

Measurements of Radio-Transmitted Energy

A very interesting article by Mr. M. Reich on some results of quantitative radio-transmission observations has appeared in *Physikalische Zeitschrift*. Measurements were made simultaneously of the current strength in an antenna at a sending station and in a tuned antenna at the receiving station. The ratio of received to sent current was measured at various wave-lengths, and also at various distances; that is, between different pairs of stations. Over a short distance (7 km) the observed received current was about 15 per cent short of the computed received current with 1-km waves, neglecting absorption, this loss being possibly attributable to imperfect ground conduction. With quarter-kilometer waves the loss increased to about 33 per cent. Over longer distances (a few hundred kilometers) the observed received current was only about half of the computed received current. The indicated loss was thus about 50 per cent. The loss was found to increase with drought and also with the frequency, the loss being greatest on short wave-lengths. Over hilly country the loss was greater than over flat alluvial soil. At night-time the loss was in general considerably less than in the daytime but was subject to greater fluctuations. About sunset the received current strength was found to undergo marked fluctuations. The particular sunset observations indicated two marked maxima, separated by about ten minutes of time. In this case both stations seem to have been approximately on the same meridian and the date seems to have been at the end of November. These two rapidly succeeding maxima, with a depression between them, might be explained by the solar shadow-wall theory. If so, the phenomenon of sunset double maximum should disappear at solstices, so far as concerns this particular pair of stations.

Centralization of Energy Supply

A recent paper by Mr. C. Vernier before the British Institution of Electrical Engineers at Newcastle brings to the front the growing importance of concentrated supply. This is one of the points in which English practice is generally behind that in our own country. Mr. Vernier points out that, chiefly owing to the great number of small municipal undertakings maintained in isolation as a matter of local pride, the condition of the average British station as respects cost of production and load-factor is bad. When only some 2 per cent of the various undertakings show a works cost as low as 1 cent per kw-hr., even with British costs of fuel and labor, the need of reform is evident. The result is easily understood when one realizes that very few of the plants can boast of a load-factor as high as 25 per cent. This is one of the depressing effects of small municipal enterprises which do not appear on the surface but are very evident when a general view of the situation is taken. Contrasting this with the extraordinary results reached in some American systems, notably those about Chicago, one is impressed more strongly than ever with the economic value of the physical union of these scattered plants in a coherent and well-administered whole.

The difference between the trend of work here and that in England is still further emphasized by the fact that the density of population in England is more than twenty times that in the United States. If one stops to consider what this difference in density of service means, one plainly sees why it is that with relatively high costs of production the British stations are able to sell energy at a relatively low rate and yet present fairly creditable balance sheets. We know of no authoritative figures which plainly set forth the cost of distribution in American stations, but obviously, from the mere difference in density of population, it must be very much greater than in British systems, a fact which our commissions will do well to consider before trying to draw any parallel between rates here and abroad. The same difference bears directly upon the matter of overhead and underground distribution. Mr. Vernier feels keenly the disadvantages imposed on electrical distribution by throwing obstacles in the way of acquiring rights for overhead transmission lines, and notes how unfavorable is the situation of England in this respect compared with that of Italy and Switzerland, both of which countries have legislation compelling the granting of rights-of-way over private property. Once granted the right of eminent domain or its equivalent, it would be possible for the British

stations to be linked into great networks as is the practice here, which would greatly aid the economy of production and distribution and make it possible for the consumer to obtain energy at even lower prices than at present. At Newcastle some of these advantages are now being realized.

With respect to the introduction of such improvements in the case of municipal undertakings, Mr. Vernier very properly draws attention to the trend of work carried on in Germany, which is facing somewhat the same set of problems, and in particular mentions the co-operation of municipal and private undertakings in such work. Strasburg, for instance, owns a large block of stock in the company from which it and other cities obtain energy and several years ago was receiving more than $100,000 annually in clear profits from this investment for the relief of local taxation. The same co-operation between city and private investors is being tried in a number of other German cities with gratifying results. No stronger evidence of the soundness of the American practice of physical consolidation of small plants into a great system can be found than the contrast here furnished with British practice and the frank recognition of the value of the lesson thus enforced by American engineers.

Combined Synchronous and Induction Motor Loads

The article which we print this week by Mr. H. L. Wallau clearly indicates the great commercial importance of the power-factor in distributing systems. It goes to show, for example, that the investment per kilowatt delivered, outside of land and buildings, is, roughly speaking, inversely as the power-factor, so that with a 50 per cent power-factor the investment per kilowatt sold is approximately double that at unit power-factor. Moreover, aside from the operating cost, the inconvenience and trouble in operating a system increases rapidly as the power-factor decreases. The author shows how much improvement may be effected in a low power-factor system by the judicious use of synchronous condensers.

The term "wattless" load used by the author might suggest that such a load of quadrature volt-amperes is devoid of watts or contains no power, thus giving a very false impression, because it is known that the quadrature load is just as "wattful" and imbued with true power as is the paying load. The active component of power carries the energy out of the circuit, mainly through the customers' meters, whereas the reactive component, or quadrature component, of power merely carries energy to and fro from one part of the circuit to another. If an express company having several offices in the same town engages in a delivery business for the sole purpose of carrying manufactured goods from its town offices to surrounding villages, it may constantly employ, say, 100 wagons, ninety of which are regularly occupied in the village-delivery work, from which the company's income is derived, while ten are regularly occupied in sorting and internally distributing the goods between the different offices in the town. The power-factor of such a system might be defined as 90 per cent, but the power of the wagons engaged in hauling goods to and fro inside the town, without any direct compensation, would be just as real power as that of the wagons engaged for paying load. Whenever energy is carried to and fro over a conductor, electric power exists and true watts exist, although such power may not win any commercial compensation and may be very wasteful economically. We purpose to publish a series of articles on the subject of synchronous apparatus applied to improving alternating-current circuit-operating conditions, and Mr. Wallau's article opens the subject from a very practical viewpoint. We believe that it will be of interest to all who are concerned with energy distribution, from either the scientific, the practical or the economic direction.

Efficiency of Incandescent Lamps

In a recent letter to *The Electrician* of London, a writer criticises that journal for misuse of the term "efficiency" relating to tungsten lamps as expressed in watts per candle. The editor of *The Electrician,* in his reply, agrees with the writer but points out that his journal merely abstracted a paper recently read before the American Institute of Electrical Engineers, so that, by inference, he politely passes on the blame to the A. I. E. E. Of course, it is recognized as illogical to express the efficiency of an incandescent lamp in watts per candle, because the greater the efficiency thus numerically expressed the less the efficiency that the lamp must have. The Standardization Rules of the A. I. E. E. have long recognized this inconsistency, but unfortunately an attempt has been made to define the "efficiency" of a lamp first in "mean spherical candles per watt" and more recently in "lumens per watt" at the lamp terminals. This use of the term avoids the blunder of inversion, but is certainly far from correct, necessitating as it does a new and unwarranted change in the meaning of the word "efficiency" to cover this special case.

A writer employing "efficiency" in the sense of watts per candle ordinarily justifies himself on the score of extensive usage. He may, for example, persist in using a wrong term in his desire to avoid the appearance of pedantic chauvinism. We cannot help thinking, however, that no amount of usage can justify obvious misrepresentation. So long, for example, as a mile is a unit of length and an hour is a unit of time, it must be illogical to express speeds in "hours per mile." Such a practice, if it were actually followed, would be stultifying to the users, even though it were universally employed. It would be absurd and erroneous to express the efficiency of a motor in kilowatts per horse-power; it would be less absurd but equally erroneous to express it in horse-power per kilowatt, the only correct method being to allow the efficiency to represent the ratio of the output to input when expressed in the same units. Concerning the relation between watts and candle-power of incandescent lamps the best plan is obviously to speak of the watts per candle or watts per lumen as the "specific consumption" and the candles per watt or lumens per watt as the "specific output," and to allow the term "efficiency" to fall into innocuous desuetude. Some day, perhaps, when we are better acquainted with the laws of energy radiation than we are at present, we may return to the use of "efficiency," in relation to a lamp, in the same sense of a pure number, or the ratio of watts emitted luminously to total watts input at the terminals.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Meeting of Public Policy Committee

The public policy committee of the National Electric Light Association met at the headquarters in the Engineering Societies Building, New York, on Nov. 17. The following were present: Messrs. Arthur Williams (chairman), Charles A. Stone, Henry L. Doherty, J. B. McCall, Samuel Scovil, Thomas E. Murray, W. W. Freeman, Herbert A. Wagner and Samuel Insull. A large part of the meeting was devoted to discussion of the subject of conservation and water-powers, which the committee has decided to study on the broad lines which characterize its consideration of large questions of public policy. This subject will be treated by the committee in a report. In connection with the discussion on this matter the following committee was appointed to attend the National Conservation Congress, which met in Washington this week: Messrs. W. W. Freeman, Herbert A. Wagner, H. G. Bradlee and Arthur Williams.

Officers of Jovian Order in Baltimore

The Jovian Order of Baltimore has elected the following officers: Mr. William L. Wilson, president; Mr. J. W. Crowley, vice-president; Mr. Harry L. Lemmert, secretary; executive committee, Messrs. J. G. Johanneson, R. C. Fought, M. H. Jones, M. I. Dukehart, R. F. Bonsal and S. J. Blight.

The order plans to discuss the subject of electrification of railroad terminal property within the city limits of Baltimore. It is hoped that the first address on this topic will be presented before the order by Mayor Preston and that later a representative of the Pennsylvania Railroad Company will discuss the matter.

Inauguration of Hales Bar Plant on Tennessee River

At Chattanooga, Tenn., Nov. 13 there was celebrated the opening of the 56,000-hp Hales Bar hydroelectric plant of the Chattanooga & Tennessee River Power Company described in an illustrated article in our last issue. Special trains carried to Chattanooga a large number of well-known financiers, engineers and public officials to take part in the ceremonies. Nearly 200 men of prominence were among the guests, the central figure being Mr. Nicholas F. Brady, son of the late Anthony N. Brady, who conceived and carried through the Hales Bar development.

To Miss Annie Gavit and Miss Jane Brady was given the honor of starting up the huge machine. Following this ceremony a buffet luncheon was served in the power house. With Mr. Paul J. Kruesi acting as chairman, addresses were made by Messrs. T. C. Thompson, Mayor of Chattanooga; B. T. Burt, general manager Chattanooga & Tennessee River Power Company; John A. Patten, president Tennessee River Improvement Association; Wilmer L. Moore, president Atlanta Chamber of Commerce; Newell Sanders, ex-United States Senator; T. E. Murray, vice-president New York Edison Company; C. J. Crowley, engineer for Jacobs & Davies, and Governor B. W. Hooper.

The party returned from the plant by special cars which conveyed them to Signal Point on Walden's Ridge, a place of great scenic interest. Here, at the Signal Point Inn, a dinner was served to the visitors by the Chattanooga Chamber of Commerce. Ex-Senator James B. Frazier acted as toastmaster and addresses were made by Col. John Bogart, Mr. E. B. Allman, speaker of the Alabama House of Representatives; Gov. B. W. Hooper, Mr. Thomas E. Murray, Mr. Adolph S. Ochs, publisher of the *New York Times;* Mr. Charles M. Jacobs and Mr. C. E. James.

Vanderlip on the Society for Electrical Development

Mr. F. A. Vanderlip, president of the National City Bank, New York, has expressed in unmistakable terms his belief in the purposes of the Society for Electrical Development. In a recent letter relating thereto he stated that the society is founded on right principles and that it is constructive in every way. He says: "It is based upon the theory of broadening the scope of its members' activities and not of being in any way detrimental to one for the benefit of another. At the same time, its own success is so involved with good service to the public that mutual advantage must be derived from its activities. By the extension and the enlargement of central stations and the broader dissemination of electrical service much economy directly beneficial to the public can be effected. In the education of the public along the line of increasing electrical facilities, diverse load-factors can be obtained and service thus greatly cheapened. I believe the society, while based upon the natural desire for more business for its members, is at the same time doing real public service, and it should receive hearty support."

A. I. E. E. Affairs

At a meeting of the board of directors of the American Institute of Electrical Engineers held in New York on Nov. 14 President C. O. Mailloux reported that the reorganization of the executive committee of the committee on organization of the International Electrical Congress of 1915 had been completed, as follows: Dr. Charles P. Steinmetz, honorary president; Dr. E. B. Rosa, honorary secretary; Mr. H. G. Stott, chairman; Mr. John W. Lieb, Jr., vice-chairman; Mr. C. O. Mailloux, chairman sub-committee on international relations; Dr. A. E. Kennelly, chairman sub-committee on program; Mr. Henry A. Lardner, chairman sub-committee on Pacific Coast relations; Mr. H. H. Barnes, Jr., chairman sub-committee on transportation; Prof. George F. Sever, chairman sub-committee on entertainment; Mr. Preston S. Millar, secretary-treasurer, and chairman sub-committee on publicity; Mr. F. L. Hutchinson, secretary A. I. E. E. (ex officio).

The board authorized the following meetings in addition to the New York monthly meetings and the midwinter and annual conventions: An Institute meeting in Washington, D. C., April 10, 1914, under the auspices of the electrophysics committee; an Institute meeting in Pittsburgh, Pa., April 23 and 24, 1914, under the auspices of the Pittsburgh Section and the committee on the use of electricity in mines; an Institute meeting in Pittsfield, Mass., May 29, 1914, under the auspices of the Pittsfield Section, and a Pacific Coast meeting in Spokane, Wash., September, 1914.

The president was authorized to appoint three representatives of the Institute upon the recently organized United States national committee of the International Illumination Commission, and $100 was appropriated as the Institute's one-third share of the United States national committee's contribution toward the expenses of the commission. The other bodies represented on the committee are the American Gas Institute and the Illuminating Engineering Society.

Issue Between Public Service Commission and Company at Nevada, Mo.

Differences have arisen between the Public Service Commission of Missouri and the Nevada Water, Light & Traction Company, of Nevada, Mo., which will be taken to the courts. The commission holds that it has power to remove officials or employees of the company.

Mr. W. H. Hallett, attorney for the company, telegraphed to the *Electrical World* that the holding of the commission is in direct conflict with the decision of the Supreme Court of Missouri, to which the case will go on appeal by the company. The commission approved a rule requiring cash deposits to secure payment for meter service and also held that the consumer should be given the privilege of furnishing personal security in lieu of a cash deposit. The commission also held that it has power to change the rates fixed by franchise.

Upon inquiry by the *Electrical World* the commission telegraphed that citizens complained against the manager of the company, maintaining that his removal was for the benefit of the public. The commission states that the number of consumers had decreased. The commission holds that it has power to order a defendant corporation to remove a manager and secure the services of competent persons.

Wakefield Municipal Plant to Purchase Energy

At a largely attended town meeting at Wakefield, Mass., Nov. 17 the citizens voted to discontinue electrical production at the local municipal lighting plant and to purchase energy from an outside source for a trial period of one year. The local lighting board announced at the meeting that outside energy can be secured at one-half the cost of operating the existing station. It was suggested that a reduction in rates from the present 15-cent to a 10-cent maximum would be possible under the new arrangement. At the meeting the fact was also brought out that municipal operation has cost the town about $240,000 more for street and commercial lighting than would have been the case had energy been secured at rates prevailing in the vicinity. The Malden Electric Company and other energy-supply organizations may be asked to offer competitive bids.

The Electrical Contractor's Problems

At the meeting of the Kansas City Electric Club Nov. 11, Mr. J. G. Berrett, of the Holophane Works of the General Electric Company, and Mr. A. J. Burns, electrical contractor and secretary of the Electrical Contractors' Association of Missouri, both made addresses on the topic of the Society for Electrical Development. The aims and methods of the society were described, and members of the Kansas City Electric Club were urged to join in the national movement for popularizing electricity.

"I am looking forward to the time," said Mr. Burns in the course of his remarks, "when the contractor will have the same recognition as a business man that is accorded to the manufacturer and to the jobber. This can be accomplished only by educating the contractor in business methods and will be done to a great extent by the co-operative efforts of all the interests involved in the promotion of electrical consumption. At present the manufacturer and the jobber are setting too low a margin of profit for the contractor. They expect him to be able to make a profit on a margin of 10 per cent, although it costs him not less than 15 per cent and often 25 per cent to do business without a profit.

"The electrical construction work done by Kansas City contractors reaches above the half-million mark annually and is increasing every year, yet these contractors are not making money. It is to be hoped that central stations will in the near future be satisfied with the sale of electricity and allow the contractor to install and merchandise appliances at a profit."

Supply Jobbers' Convention

By Telegraph

The November meeting of the Electrical Supply Jobbers' Association was held at the Homestead, Hot Springs, Va., on Tuesday, Wednesday and Thursday of this week. Sessions for members only were held on Tuesday afternoon and evening and on Wednesday and Thursday morning, with an open session on Wednesday evening. Routine work occupied the sessions on Tuesday, although some time was devoted to questions arising between the manufacturers and jobbers. The Wednesday morning session was addressed by Mr. Norman E. Webster, of Niles & Niles, certified public accountants, New York, and Mr. A. A. Gray, editor of the *Electrical Review and Western Electrician*, Chicago.

Classification of Accounts

Mr. Webster spoke on sales analysis in the jobbing business. He emphasized the three principal points made in a paper read at the Chicago meeting last May as follows: First, that there should be such a classification and grouping of the expenses as would assist in ascertaining the cost of doing portions of the business separately from the other parts; second, that there should be such a classification of the sales as would disclose the profitable and unprofitable business, not alone on the basis of the percentage of gross profits but also on the basis of the percentage of net profit after deducting the expenses applicable to particular lines or classes of sales, and, third, that there should be a standard uniform classification for use by all jobbers, with the result that more valuable comparisons could then be secured.

Mr. Webster also said that the following conditions should be met. The accounting system should be such as to enable each jobber to be fully informed about his own business, even considering all its peculiar and varying conditions. It should be such that by comparisons of results on similar matters he can learn wherein his business is conducted more or less efficiently than others. It should be such that from the statistics of a number of houses average conditions can be ascertained and considered in their joint or individual dealings with those from whom they buy and to whom they sell, and that these average conditions may also be placed before other members whose methods are not in harmony with what are considered to be for the best interests of all. The accounting system should also be such that it will give this information promptly, much of it automatically, and also such that, in special matters, the information may be obtained before its usefulness is past. Finally, the accounting system should be one adapted to the conditions in small and large organizations, one in which the work may all be done in the ordinary way with pen or portions of it done by mechanical devices, and it should not be expensive.

Having previously suggested a classification of expenses, the author devoted most of his paper to the subject of sales

analysis, the following being a summary of the recommendations: First, that the sales, cost of sales and gross profits be classified broadly by lines of merchandise; second, by salesman's territory; third, by classes of customers; fourth, that sales be analyzed into stock and direct shipments and by classes as to the amount of the bills.

The entire matter is being put into a report by the accountants which will contain the definitions of the required accounts and forms for the monthly statements, and the association voted that the report be distributed to all its members.

Economical Distribution of Supplies

Mr. Gray addressed the jobbers on the topic "The Electrical Jobbers as an Economic Factor in the Distribution of Supplies." According to Mr. Gray the electrical jobber is an economic factor in the distribution of supplies. His elimination or any movement in the direction of curtailing his usefulness would throw a burden upon the industry and increase the cost of energy-consuming devices to the ultimate consumer. This would retard the business and keep back the development of the industry. The jobber, however, will continue as an economic factor only so long as his organization renders easy the merchandising of supplies and co-ordinates his selling and service efforts with those of the manufacturer, so that material may pass from the latter to the consumer with the least degree of resistance and at the lowest possible expense in handling. As the demand for electrical material increases the demand will also increase for high-grade material at a reasonable price. The manufacturer of electrical apparatus has put a greater amount of skill, ability and courage into the production of his goods and has got less in return than the manufacturer in any other industry. The price of electrical goods is as low as is consistent with the production of standard material and an adequate return for the labor involved.

In this situation the supply jobber must so conduct his business that there shall be no additional burden thrust between the consumer and the producer.

Society for Electrical Development

At the Wednesday night session Mr. H. H. Cudmore, of the Society for Electrical Development, outlined the aims and objects of that body in a convincing manner. His efforts were encouraged by Mr. E. W. Rockafellow, of the Western Electric Company, who read a letter from Mr. W. E. Robertson, who represents the Jobbers' Association in the Society for Electrical Development. Transmitted with the letter was a characteristic one from Mr. J. R. Crouse. Mr. W. N. Matthews, of St. Louis, the reigning Jupiter of the Jovian Order, also spoke in favor of the electrical development society, as did also Mr. A. A. Gray.

During an executive session Mr. A. D. Page, of the General Electric Company and representing the incandescent lamp manufacturers, addressed the body on the lamp-sale agreement existing between the jobbers, acting as agents, and the lamp manufacturers.

Discounts in the Settlement of Accounts

At the closing session on Thursday morning the meeting was addressed by Mr. Frederic P. Vose, of Chicago, and Mr. H. R. Brand, of New York City. Speaking on the topic "Discounts in the Settlement of Accounts," Mr. Vose, who is secretary of the Electrical Credit Association of Chicago, said:

"Price terms and payment terms are of equal dignity in a bargain and sale. Yet payment terms mean something indefinite to the manufacturer, jobber and retailer, but something decidedly definite to the banker. The purchaser is inclined to think that 'cash discount' is added to the price of goods as a penalty to be suffered if he fails to pay within the discount period. Therefore, he concludes that he is entitled to deduct the 2 per cent at any time and thus bring the cost to him to the proper figure. Cash discount, however, is the premium offered for the use of ready money. If the seller does not get the use of the money, he should no more be charged for it than should the buyer be charged with goods that he does not receive. Terms of payment, it seems, have come to mean: thirty to sixty days, 'out of town'; ninety days, 'hard up,' and 120 days 'about to settle.'

Protecting the Prompt-Paying Customer

"Every payment after maturity should be accompanied by the legal rate of interest. Regard it as a penalty when applied to a merchandise transaction, but it is the regular order for the banker. It is time the law merchant became equally positive in trade terms. Why should a prompt-paying customer be discriminated against? He pays according to the terms and his money helps to carry the slow customer who may be a trade pirate or an unfair competitor of the prompt-paying customer. Nothing but weakness on the part of the seller permits of the continuance of such unfair practices. Cash discounts insisted upon lessen the hazards of business. A customer should not be carried without interest from date due even to secure or to retain his business. To indulge him thus makes the manufacturer or jobber his banker without interest. Some buyers deliberately take unearned cash discounts and some sellers willingly extend the period. This is unfair competition and price cutting. The two main talking points in sales are, first, the goods (price, quality, efficiency and service) and, second, the terms upon which they may be obtained. Friction would be lessened if terms of payment were made plain at the outset."

Customers who cannot pay in thirty days should not look to the seller to carry them without interest. If the trade will not unite on insisting on interest on matured receivables, then, Mr. Vose insists, in fairness to the prompt-paying customer, the tardy-paying customer should pay an increased price. Another allied subject which he touched on was that of prompt and systematic collection methods, which not only benefit the seller but which tend to educate the buyer in handling the retailer or consumer. The customer should understand that the extension of uncertain credits ultimately works an increase in prices.

In conclusion, the author observed that if cash discounts for immediate payments cannot be done away with, then the jobbers' and the other active associations in the trade are big and strong enough to insist upon regarding sales contracts as being equally binding upon both vendor and vendee in law and morals. Anything short of that is unfair and lacks the primary elements of a square business deal.

Daily Record of Net Profits

Mr. Brand outlined a system of accounting whereby net profits may be known daily. He likened his system to the steam gages, voltmeters, ammeters, etc., of the station engineer by the aid of which the latter knows exactly what his plant is doing every minute of the day. The autho: enumerated the various elements which combined make it possible to produce in any business a registration of business efficiency to such an extent that the manager can know from day to day the net worth of the business. The efficiency of both the producing and non-producing departments is also registered. The author is seeking to enlist the attention of trades associations in promoting his educational campaign so that he may bring about a universal condition whereby every business man will be fully protected against bad management. It is claimed that less bookkeeping and skill are required than with the ordinary system of accounting and that trial balances are eliminated.

The attendance at the Hot Springs sessions numbered about 260. The next meeting of the Jobbers' Association will be held at Washington, D. C., late in February. The 1915 convention is scheduled for San Francisco in May.

Proceedings of the Fifth National Conservation Congress

The National Conservation Congress, which is the outgrowth of the conference of Governors of the states which met for the first time at the White House five years ago, held its fifth annual session at Washington on Nov. 18, 19 and 20, preceded on Nov. 17 by the annual meeting of the National Association of Conservation Commissioners and of the forestry section of the congress. The 1913 congress was devoted to forestry and water-power. Of these two subjects the latter occupied the principal attention of the congress, because of the situation in this country, in which the development of water-power resources has, in the opinion of many students, been greatly retarded.

Mr. Franklin K. Lane, Secretary of the Interior, who made the first address, urged co-operation between the states and the federal government. He said that the great difference among conservationists lies in the conflicting opinions as to state rights. It has been said that the United States is divided in opinion among Hamiltonians and Jeffersonians, between those who believe in a strong federal government and those who believe in a government more decentralized, between the federalists and the state rights men, but the truth is that in government the test is that of efficiency.

Mr. Lane added that the government is not wedded to any particular theory. It is wedded to the idea of practical tests which may work out something to better the country. It is indifferent to the agency employed. The states and the central government can co-operate, and manifestly there can be no success unless there is such co-operation.

The report of the committee on water-power was presented by Prof. George F. Swain, the chairman. The other members of this committee are Messrs. Gifford Pinchot, Henry L. Stimson, ex-Secretary of War; Lewis B. Stillwell, of New York; A. F. Lever, Congressman from South Carolina; Charles R. Van Hise, of Madison, Wis.; M. O. Leighton, of Washington, D. C.; E. S. Webster, of Boston; B. M. Hall, of Atlanta, and Joseph N. Teal, of Portland, Ore.

Majority Report of Water-Power Committee

Separate reports were presented by the majority and the minority members of the committee on water-power. The full committee, however, joined in making definite recommendations.

The report of the majority, presented by Prof. George F. Swain, chairman, was concurred in by Messrs. Lewis B. Stillwell, M. O. Leighton, Edwin S. Webster and B. M. Hall. This report states that there are three essentials of a sound water-power policy: (1) prompt development, (2) prevention of unregulated monopoly, (3) good service and fair charge to the consumer. The regulation of service and charge is usually a state or local function. It should be exercised by the nation only in interstate industry and possibly when the failure of other agencies might result in abuses.

The majority of the committee refers to three kinds of natural material resources, those which are not renewable, those which are self-renewing, and water-power which, if not utilized, is immediately wasted with no good results to anybody. The utilization of water-power for a purpose for which steam power, or some other form requiring the use of fuel, would be employed is not only the utilization of a freely given resource which would otherwise be wasted but it involves the saving of a corresponding amount of one of the non-renewable resources. The conservation of water-power, therefore, is a double conservation.

In conserving the non-renewable and slowly renewable resources, the avoidance of waste, maximum economy and economical and restricted use should be the guiding principles. In the case of water-power, however, a point of view almost the opposite of this condition, within proper limits, would seem to be the true one. Any proper use is better than no use at all.

The majority says that there would seem to be no form of individual enterprise more worthy of encouragement or which in the interest of true conservation should be made more tempting to the investment of capital than the development of water-powers. Laws and regulations governing the development of water-power should properly be made so that an adequate rate of return to the investor might reasonably be anticipated. While sometimes a water-power may be developed at slight expense, in many cases, if not in most cases, especially in the case of the largest water-powers, a very large investment of capital is necessary. Moreover, the risks attending this investment are often serious.

The majority says that three things are essential to induce the investment of private capital in water-power enterprises, as follows: definiteness in the contract, the prospect of a sufficiently attractive return commensurate with the risk involved, and the protection of the courts in case of disputes. Notwithstanding the fact that electricity is playing every day a more important part in social and industrial economy and the fact that the development of hydroelectric properties should be proceeding rapidly, there seems no doubt that present federal laws and the permits hitherto issued under them have brought about a condition of relatively slow development of water-power. The committee approves of the indeterminate form of franchise.

In conclusion, the majority says that because of the large first cost of water-power developments the risk of loss in case of failure of the enterprise is correspondingly large. Capital, therefore, does not need water-power enterprises, and it will not take them up to any considerable degree, unless fully protected.

Minority Report of Water-Power Committee

The report of the minority, presented by Messrs. Henry L. Stimson, Joseph N. Teal and Gifford Pinchot, discusses the subject of concentration and development, stating that in the last two years the great power interests have increased their control of power held undeveloped more than twice as fast as they have increased their control of developed power. It declares that no right to use a public water-power should ever be granted, unless the grantee can show that it controls no water-power not developed or in process of development, or that there are sound reasons from the public viewpoint for leaving such controlled power undeveloped and asking for a further grant.

In conclusion, the minority says that while the effort to secure the passage of sound and needed water-power legislation has not yet succeeded, the passage of bad legislation has become increasingly difficult.

Unanimous Recommendations of Water-Power Committee

The unanimous recommendations of the committee are in brief that the following principles should govern the privilege to use a water-power. For a definite period, sufficient to be financially attractive to investors, the privilege should be irrevocable except for cause reviewable by the courts. Thereafter the privilege should continue subject to revocation in the discretion of the government upon payment of the value of the physical property and improvements. After the expiration of the definite period, at recurring intervals of not more than ten years the amount of compensation and all terms and conditions during the next period of not more than ten years should be determined by the government. The privilege should be unassignable except by approval of the government. The privilege should be granted only on condition of development of the whole capacity of the site and as rapidly as the granting officer may require, giving due consideration to reasonable market demands and also on condition of continuous operation,

subject to such demands. The right to receive compensation for the value of the privilege, varying according to the conditions of each case, shall be reserved to the state or federal government from which the privilege comes. The government shall have the right to prescribe accounting methods. Upon revocation of a privilege by the government, the grantee shall be paid the fair value of the property exclusive of franchise and consequential damages. This shall cover necessary appurtenances for operation of the water-power and the transmission of electricity therefrom, but shall not include such properties as railroads, lighting systems, factories, etc., which are separate industries.

Address of Gifford Pinchot

Mr. Pinchot said that the greatest necessity in the water-power situation and the next great step in conservation is immediate water-power development on terms fair to the public. Figures compiled by the United States Bureau of Corporations and brought up to date by the National Conservation Association show beyond question, Mr. Pinchot added, that the central fact in the water-power situation is concentration of control. Concentration in water-power has nearly doubled in the last two years. The ten greatest groups of water-power interests to-day control nearly twice as much water-power as the ten greatest groups of two years ago controlled then. The ten greatest groups of to-day control 65 per cent of all the developed water-power in the United States, and a single group, composed of the General Electric interests, controls 40 per cent of all the developed commercial water-power in the United States.

Mr. Pinchot declared that in the last five years the concentration of control in the ten greatest groups has increased about seven times faster than the total of all water-power development in the United States. The ten greatest groups have increased their control of undeveloped power in the last two years more than twice as fast as their control of developed power. In ten states one company and in seven States two companies control from 42 to 96 per cent of all the developed commercial water-power, and in fifteen of these seventeen States each of these companies was organized or reorganized within the last three years.

It is argued that concentration of water-power control is increasing faster than power development because high risks and low returns keep capital away. But, according to the figures published by one of the ten greatest groups of power interests, in the last ten years the net earnings of the gas and electric companies of the United States have never dropped below 8 per cent, as against 4.25 per cent for railroads and 7.79 per cent for industrial corporations. As shown by the annual amount of securities in receivers' hand per $100 of outstanding securities, the water-power interests are nearly five times safer investments than railroads, more than five times safer than industrial corporations, and about as safe as national banks.

Water-power as a natural monopoly is peculiarly subject to industrial monopolization and offers peculiar inducement to monopolistic control, Mr. Pinchot said. Since it costs less to produce than steam power while the price at which it can be sold is substantially determined by the competitive cost of steam, water-power is extremely profitable, as the eagerness to get possession of it sufficiently proves. The control of any source of mechanical power—coal, oil, natural gas, water-power—carries with it control over the industries which require the power, as the rapidly increasing domination of water-power interests over electric light and street-railway companies well illustrates.

Continuing, Mr. Pinchot said that under these circumstances the control of the water-power business, like the control of oil, meat and anthracite coal, is passing into a few strong hands. Like coal, meat and oil, mechanical power from falling water is a necessity of modern life. Control over a necessity of life is control over the people who must have that necessity. Private monopolization of any necessity of life means private control over the people without responsibility to the people. It means also the power to increase the cost of the necessaries of life, and therefore the cost of living, without regard to the public interest, up to whatever point will yield the largest profit.

Mr. Pinchot argued that the commonest and most plausible argument of certain water-power interests is that full protection to the public interest will check development, while the conclusive answer should be that in actual practice it does not.

Under regulations of the Forest Service, which include also the provisions objected to by certain power interests as sure to hamper development, there were in the national forests on Oct. 1, 1913, according to Mr. Pinchot, seventy-eight water-powers developed, thirty under construction and no less than seventy-six, capable of developing 728,300 hp at low water, for which permits had been taken out within the past two years, under conditions requiring prompt development. The total rating of all these powers is about 1,090,000 hp reckoned on minimum stream flow, or not less than twice that amount in actual fact. The speaker quoted these figures as finally and completely disproving the claim so often heard that proper government regulations check development.

In concluding, Mr. Pinchot said that since water-power first became a public question the friends of conservation have done their best at every session of every Congress to get consideration for legislation fair to both sides. At every session certain water-power interests which would be satisfied with nothing less than all checked the movement or killed the legislation. Year by year, nevertheless, it has grown more certain not only that the public must have some consideration but actually that the public rights come first. Some fair-minded water-power men have seen this all along. When their influence predominates with the water-power interests, as it soon will do, the speaker declared, a better day may be expected.

Declaring that the cause of conservation is to face this winter in Washington the most serious fight in its history, Mr. Charles Lathrop Pack, the retiring president of the congress, said that perpetuation of resources could be best achieved by present use along scientific lines.

Describing the work of the Canadian Commission of Conservation, James White, Deputy Commissioner, said that an investigation of the water-powers of British Columbia and the prairie provinces has been carried on during the last three years. Recommendations have been made to the various governments urging the leasing of water-powers for a definite period on condition of prompt development and compensation to the crown and control of rates. These principles have been adopted for water-powers in Ontario, Manitoba, Alberta, Saskatchewan and, in a modified form, in British Columbia. The other provinces will probably introduce similar legislation soon.

The congress adopted the principles on which the members of the committee agreed unanimously. In connection with the discussion of the report, however, acute differences on the subject of federal and state rights developed. The delegations from Arkansas and Washington left the convention, charging that the congress was filled with employees of the Government Forest Service and former employees of the government. The issue on the question of federal or state rights was raised by the presentation of the two reports on the subject of water-power, the majority report favoring the regulation of service and charge by the state or local government and the exercise of such a function by the nation only in interstate industry and possibly when failure of other agencies might cause abuse, while the minority report favored federal regulation. Dr. Charles R. Van Hise did not sign either report.

Electrical Equipment of Gasoline Automobiles

At the 288th meeting of the American Institute of Electrical Engineers, held at New York, Nov. 14, the general subjects of electric lighting and self-starting of gasoline motor cars were discussed in papers presented by Messrs. Alfred E. Waller, Alexander Churchward and Frank Conrad.

The design of motor-car lighting apparatus, said Mr. Waller in his paper, entitled "Dynamo Electric Lighting for Motor Cars," should begin with the choice of satisfactory lamp equipment. This fixes the power required and indicates the generator rating needed. For head-lamp purposes the 21-cp, 6-volt tungsten lamp with a 10-in. parabolic reflector has been chosen as most satisfactory. For the side and rear lamps 4-cp and 2-cp units give ample light, the limiting size being only the strength of filament necessary to withstand the motion of the car.

Much of the mileage covered by the average motorist is traversed at a speed of 18 miles an hour or less, so that the generator must come into operation at low rates of car travel. Provision must also be made for protecting the generator at very high car speeds. Among the methods of regulation employed are slipping clutches, governor-controlled resistances, use of high armature reaction, bucking field windings, iron-wire armature coils, auxiliary poles excited by cross magnetization, ballast-type feeder circuits and cam-opened brushes. The author recommended the two-wire system of distribution, pointing out that the single-wire scheme with car-frame return may bring about ignition complications. He also urged that manufacturers of car-lighting systems cut all wires and connections to length and have them properly marked so that mistakes by unskilled installers will be avoided.

Clutch-Type Generators

Mr. Alexander Churchward discussed the "Advantages of Clutch-Type Generators and Separate Starting and Lighting Units for Motor Cars." The advantages of constant-speed dynamos for automobile lighting were enumerated by the author as follows: The battery is charged with a current roughly inversely proportional to its own condition of charge. The generator runs at low speed, avoiding wear and adjustment. Its efficiency even with much slipping of the clutch is higher than with certain schemes of electrical control. It can be geared to cut in at very low car speeds.

For cranking purposes all traction experience has shown the advantage of the series-type motor with steep torque characteristics. The author therefore recommended the use of a double-unit system comprising a shunt-wound dynamo for battery charging and a series motor for self-starting. Such a 6-volt double-unit set, he insisted, is as light and cheap as a single-unit equipment and will be more efficient per pound than any system designed for a higher voltage.

Proper Ignition with Car-Speed Variations

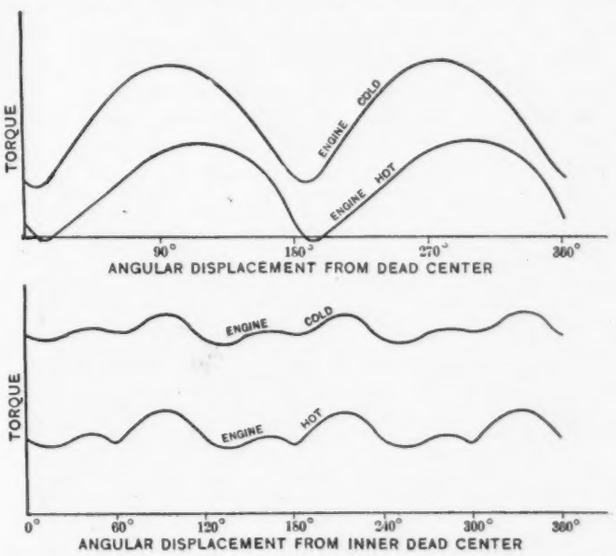
Mr. Frank Conrad, author of the paper on "The Electrical Equipment of Gasoline Automobiles," discussed first the relative merits of various ignition systems, advocating as best the use of an induction coil operating from a constant-potential circuit in connection with a device that will limit the current at low speeds. By means of a mechanism comprising two centrifugal cams which change their position with change in car speed, the contact device can be held closed for a constant period of time, regardless of the car speed. Incidentally the instant of break is advanced with increase of speed, to allow for the time required for the cylinder mixture to explode. The lighting generator chosen, said Mr. Conrad, should be able to supply the ampere demand of the lamps with the car running at 15 miles per hour. The author advocated the use of a demagnetizing series coil in the battery circuit as a means for maintaining constant charging current. He also advocated use of a separate starting motor in order to avoid complication.

In opening the discussion Mr. John M. Hipple, who, as chairman of the industrial power committee, was appointed by President C. O. Mailloux to preside at the evening's technical discussion, made the comment that the design of electrical equipment for gasoline automobiles is still in its early development and that certain of the unfit equipments now on the market must be eliminated in order to preserve the good name of electric-lighting and self-starting devices.

Requirements of Car-Lighting Systems

Mr. H. Ward Leonard recounted his own early work in the train-lighting field and outlined briefly as follows the nine requirements of an electric generating system designed to be driven from a varying-speed source: (1) limiting of dynamo current, (2) automatic removal of battery sulphate, (3) avoidance of auxiliary devices and supplies, (4) freedom from wear and adjustment, (5) independence of temperature changes, (6) close control of regulating devices, (7) automatic control of overcharge, (8) automatic indication of battery charge, (9) supply of lamps from the dynamo alone in case of accident to the battery system.

Mr. Leonard Kebler questioned Mr. Churchward's claims for the high efficiency of the slipping-clutch generator and declared that large losses are produced by friction at the clutch. Such clutch mechanism, added the speaker, involves rapid wear and consequent adjustment.



TURN-OVER TORQUE OF FOUR-CYLINDER AND SIX-CYLINDER AUTOMOBILE ENGINES

Mr. Almon W. Copley also challenged Mr. Churchward's claims for clutch-type operation and declared that the wear of the chains and gears and the adjustment of the clutch must be considered. Mr. Copley expressed himself as an advocate of the single-wire grounded system of connections, which he declared permits better insulation, occupies less room and simplifies the insulation problems of sockets, lamps and fixtures.

Two-Wire Versus Single-Wire Systems

Mr. A. D. T. Libby referred to the 6-volt limitation early put upon the automobile lighting industry and advocated the use of higher pressures, suggesting 12 volts for automobile use. An accidental ground on a single-wire system, he declared, may put all the electrical circuits on the car out of commission.

Mr. Harold Goodwin, Jr., pointed out that in a two-wire system one side often becomes grounded without attention being called to the fact, so that while being operated in this condition a second ground would completely disable the electrical equipment. For this reason he advocated the use of a single-wire system in the first place.

In a written discussion Mr. C. E. Wilson described tests made on a clutch-type generator and presented curves for comparison with those in Mr. Churchward's paper.

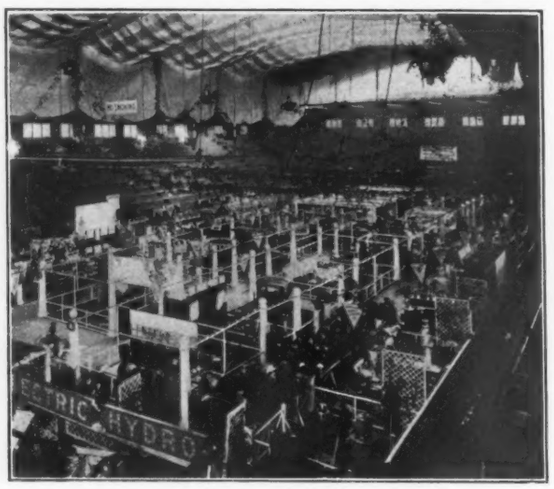
Mr. B. F. Bailey in a written discussion described the mercury type of switch devised by him for controlling a differentially compounded generator. He also questioned Mr. Churchward's assertions concerning slipping-clutch efficiencies. For lighting, starting and ignition purposes the writer recommended the use of a single generating set.

Mr. Kingston Forbes discussed the subjects of lighting and starting from the automobile engineer's standpoint. He referred to single-wire and two-wire systems of distribution and single, double and three-unit electrical equipments, concluding by recommending a combination ignition and lighting generator, with a separate series motor for cranking.

Electrical Shows at Toronto and Montreal

At Montreal, Que., from Nov. 1 to Nov. 8 an electrical show was held in the local Arena, while from Nov. 10 to Nov. 15 a similar exhibition was given at Toronto, Ont. Both shows were devoted largely to electric household appliances and devices for popularizing the use of electricity.

At the Montreal exposition the Montreal Light, Heat & Power Company was the chief exhibitor. Its large booth displayed heating and cooking appliances, lamps, motors, etc. Another attractive display of general interest was that of the Montreal Electrical Society, which showed samples of cables, wires, cords, materials, telephone apparatus, storage-battery parts, etc., of historical and educational interest. Several Canadian-built electric vehicles were also on exhibition by a Walkerville (Ont.) manufacturer.



TORONTO ELECTRICAL SHOW

The Toronto electrical exhibition, which was held in the Arena Gardens, was opened Nov. 10 by Mr. P. W. Ellis, chairman of the Toronto Hydro-Electric Commission. The speaker described the development of Niagara water-power and said that as the result of the provincial distribution scheme electricity has been brought into 20,000 homes in Toronto. The Toronto Hydro-Electric Commission exhibited a model house equipped with electrically operated laundry machinery, sewing machines, etc., and also displayed a model machine shop and office. Electricity on the farm was the subject of the display made by the Hydro-Electric Power Commission of Ontario. Four cows were milked nightly by an electrically operated vacuum apparatus, while motor-driven ensilage and straw cutters, cream separators and butter rollers were in continuous operation.

Illumination of Street-Railway Cars

Messrs. L. C. Porter and V. L. Staley, of the General Electric Lamp Works, at Harrison, N. J., presented a paper on "The Illumination of Street Railway Cars" at the meeting of the Chicago Section of the Illuminating Engineering Society Nov. 12. For car lighting, compared with carbon lamps, declared the authors, tungsten units produce better illumination at a saving in lighting expense. Where tungsten lamps are used it is desirable to install efficient reflecting devices, and in all cases a light interior car finishing is to be desired. The tungsten lamp for car lighting has reached a life of 2000 hours in laboratory test and from 1200 to 1500 hours under service conditions. The strength of the lamp is such that it withstands surprisingly bad operating conditions. It has practically superseded the tantalum lamp for car illumination.

The results of a study of car lighting made by Mr. G. H. Stickney, of the General Electric Company, with the cooperation of Mr. E. W. Holst, of the Bay State Street Railway Company, were given. Two methods of placing the lighting units were tried, one being the use of a single row of fixtures down the center line of the car and known as center-deck lighting. The other provides a double row of lighting units, one under each half-deck. There is little to choose between these two methods in efficiency, but the center-deck system is somewhat simpler and easier to install and maintain. With the center-deck system two circuits of 56-watt lamps, or one of 94-watt lamps, are used, and with the half-deck lighting 23-watt or 36-watt lamps are usually employed. It has been found that from 2.5 to 3 ft.-candles is desirable on the reading plane of passengers. This plane is considered to have an angle of 45 deg. 3 ft. above the floor. With either the center or half-deck lighting where efficient intensive-type reflectors are used approximately 82 lumens per running foot of car body will supply this illumination. This corresponds to about 10 watts per running foot, or 1.25 watts per square foot of floor area.

Tests have shown that with the common dark-yellow finish of street cars the efficiency of light utilization is approximately 15 per cent where no reflectors are used and 30 per cent with a good direct reflector system. On one cars where the finish of walls and ceiling was white, a utilization efficiency as high as 60 per cent was obtained. One pronounced advantage of the tungsten lamp over the carbon unit for car lighting is that the candle-power changes less on fluctuating voltages. Mr. Porter, who read the paper, gave a demonstration to illustrate this fact. Four tungsten lamps have been especially developed for railway service, rated at 23, 36, 56 and 94 watts respectively. The efficiency of the two smaller sizes is 1.34 watts per candle, and of the two larger sizes 1.20 watts per candle. Figures were given to show the economy of tungsten lamps compared with carbon lamps. The ultimate saving will warrant the re-wiring of old cars to enable tungsten lamps and reflectors to be used.

Discussion

Dr. M. G. Lloyd, chairman of the section, presided and spoke of the practical importance of the subject. Mr. J. R. Cravath, of Chicago, suggested that the railways prepare their own designs for reflectors, which should be simple and easily cleaned. Glassware should be heavy enough to withstand railway service. Suitable reflectors double the efficiency of lamps for car lighting. For the eye-comfort of passengers bowls should be deep.

Mr. A. J. Sweet, of Milwaukee, told of the work he has done in studying the lighting of steam-railroad day coaches. He favors the center-deck arrangement of lamps, particularly on steam roads where seating arrangements are standardized. Mirror reflectors are, of course, the most efficient, but almost any reflector is better than the bare lamp. The design of the reflector should be mainly of the

intensive type but should also have some features of the extensive-reflection type to provide light at the sides of the car.

Mr. H. H. Adams, of the Chicago Railways Company, said that the recent arched-roof cars on his company's system had originally an interior finish of a pea-green color. Bare lamps are used and the speaker made experiments to see what improvement could be effected in changing the color of the car ceilings and walls. A light buff was finally selected and this made an improvement of 50 per cent in illumination. Reflectors are no doubt valuable, but in using them the appearance of the car should be taken into consideration.

Mr. Porter referred to tests made by a steam railroad where modern prismatic reflectors and shade-holders were installed in an old box car. This car was subjected to impact from a locomotive going first at the rate of 5 miles an hour, then at 10 miles an hour, and so on. A speed of 40 miles an hour, Mr. Porter said, was necessary before the collision shattered the reflectors in the box car. Mr. Sweet had said that he thought the center line of fixtures objectionable where longitudinal seats are used, but Mr. Porter said that the angles of reflection are such that this objection is not a serious one. As to the life of tungsten lamps used in car lighting, Mr. Staley remarked that it is hard to get actual figures. The Bay State Street Railway Company of Massachusetts has been getting an average life of 1500 hours, including breakage, stealing and all the incidents of service. Under laboratory conditions the tests show a life of 2200 hours for street-railway tungsten lamps.

An interesting feature of the meeting was a small but good collection of reflectors, car-lighting fixtures and condulets shown by the Holophane Works of the General Electric Company, Macbeth-Evans Glass Company, National X-Ray Reflector Company, Adams & Westlake Company, Safety Car Lighting & Heating Company, Appleton Electric Company and the Crouse-Hinds Company.

Franchise Report Before Municipal League

A report of the committee on franchises was presented at a meeting of the National Municipal League held at Toronto on Nov. 15. The committee expresses the view that at present there is a tendency toward too great centralization in the control of public utilities and says that under some of the forms of public utility laws the powers of municipalities to control local utilities are being curtailed seriously or taken away entirely.

The judgment of the committee is that the league should inquire carefully into the significance of the movement for exclusive state control in the matter of public utilities. Certain features of exclusive state regulation tend to make the municipalization of utilities more difficult. The committee is of the opinion that in most cases regulation cannot be either logical or effective without the active cooperation of both state and local authorities. One of the arguments advanced is that a city must have control of its streets. At the same time it is clear that in the country and in small towns public authorities are wholly lacking in equipment for the regulation and control of public utility corporations. For this reason the committee concludes that it appears desirable that a state commission shall have general jurisdiction over public utilities throughout the State so that no companies may escape adequate regulation.

The report declares that every city of sufficient importance to enjoy the powers of home rule and the framing of its charter should have the right to establish a separate department, bureau or commission for supervision of utilities operating within its limits to such extent as may be necessary for the protection of distinctively local interests. Even in the larger cities, however, the State should still have jurisdiction over certain important matters. These matters are mentioned in the report as the regulation of security issues, the adoption of a uniform system of accounts, and the determination of certain fundamental questions which relate to stability of the investment. The committee is inclined to the opinion that rate-making should be recognized as a function in which local and state authorities may properly co-operate.

The committee believes that it is essential to proper development of the utilities of any city and to full realization of the principles of public control that in all cases where outstanding franchises run in perpetuity or for unreasonably long periods the city should definitely set about devising means for recapturing them. The report is signed by Messrs. Delos F. Wilcox (chairman), Robert Treat Paine, James W. S. Peters, Abraham E. Pinanski, Charles Richardson and Clinton Rogers Woodruff.

Prof. Edward W. Bemis did not sign the report. He adds a note saying that, while he agrees in the main with the views presented, he doubts the wisdom at the present time of lodging in any state commission any control of the capitalization or rates of public utilities in the larger cities, especially west of New York State.

European and American Lamps and Lighting

At a joint meeting of the New York Sections of the Illuminating Engineering Society and the National Electric Light Association held on Nov. 17 recent developments in lighting and European lighting practice were described in papers by Messrs. H. W. Jackson, of the General Electric Company's laboratories at Harrison, N. J.; Alexander Maxwell, chief of the laboratories of the New York Edison Company; S. G. Rhodes, engineer of meter testing for the New York Edison Company, and C. F. Lacombe, chief engineer of the light and power bureau of the Department of Water Supply, Gas and Electricity.

Mr. Jackson described and demonstrated the high-efficiency nitrogen-filled tungsten-filament lamp, the development of which is attributable to the research work of Dr. Irving Langmuir, Schenectady, N. Y.

Mr. Maxwell described and demonstrated the neon-vapor tube lamp developed by Mr. George Claude, of France.

Mr. Rhodes, who recently returned from a trip to Europe, where he made a study of existing street-lighting installations, described various features which differentiate European from American practice in this respect.

Among the various types of meters discussed particular attention was called by Dr. Rhodes to ampere-hour, maximum-demand, two-rate and clock units. Ampere-hour meters are employed extensively and seem to prove satisfactory largely by reason of their low cost. The circuit-opening type of demand-limiting device is utilized with good results with lighting loads, but is not highly satisfactory for use with heating and similar loads. Two-rate meters prove useful in numerous localities where the charge per kilowatt-hour depends upon the time of demand. These meters are usually arranged to give separate indications of the consumption during the low-rate and high-rate periods, the total charge for service being calculated from the two readings. Elaborate time switches have been devised and are being used for signs, street lamps and similar installations. In some cases the clocks close and open the circuit each night in accordance with the period of darkness, the time of opening being varied automatically with the seasons.

Mr. Rhodes stated that in comparison with American standards European wiring is cheap and perhaps unsatisfactory. He questioned, however, whether the American standard requirements are not too severe when the cost and risk are properly considered. The cheap wiring scheme

involving the use of a single, centrally placed insulated wire with an outer metallic-tube conductor protecting the insulation was described as one well worthy of introduction in this country.

Mr. Lacombe, who has also just returned from a European trip, spoke particularly of the street lighting in Europe, which he said is better on certain streets than that in America, although there are no actual "white ways" on the other side.

Electric-Vehicle Salon at Boston

Under the auspices of the Electric Motor Car Club of Boston an electric-vehicle salon, said to be the first of its kind, was opened in the ballroom of the Copley-Plaza Hotel, Boston, on Nov. 17 and continued for three days. Twenty-nine of the latest pleasure-car models were exhibited amid tasteful floral decorations by makers of the following vehicles: Bailey, Baker, Buffalo-Babcock, Detroit, Ohio, Rauch & Lang, Standard, Waverley and Woods. Four types of batteries—the Edison, Exide, Harwood and Philadelphia—were also shown.

Special efforts were made to demonstrate the appeal of the electric passenger car to the ultra-fashionable element

ELECTRIC-VEHICLE SALON AT BOSTON

of society without the usual commercial accompaniments of an automobile show. Leaders in Boston social life were among the patrons of the salon, and there were about 10,000 invitations issued to persons of recognized social standing in eastern New England. A reception and tea were held on Monday afternoon, presided over by the wives of the chairmen of the various committees. All visitors were furnished with catalogs as in a picture salon, and an orchestra added to the attractions of the display. No booths or advertising signs were permitted. A special parking committee cared for the cars of visitors attending the salon, which aroused great interest in the electric automobile among people of means. New England central stations co-operated in the issuing of invitations.

At the formal opening of the salon on Monday night Past-president W. H. Blood, Jr., of the Electric Vehicle Association of America, addressed a large and representative gathering, reviewing the history of the electric pleasure car and contrasting the designs of early days with those exhibited. He emphasized the point that even the early cars gave reliable, though costly, service. Their underlying principles were correct, but the working out of these ideas was crude. The modern electric vehicle appears before the public as a perfected article in which simplicity, durability and beauty are the three points of special superiority. The coach builder's art has reached its climax in the design and construction of the modern electric coupé. The storage battery of to-day lasts twice as long as those of a few years ago, while electric motors are practically indestructible. Mr. Blood also touched upon the development of the commercial car, outlined the special field of the electric machine as supplementary to that driven by gasoline, and in closing pointed out the tendency toward lower costs of electrical service in contrast with rising prices for gasoline. He cited the benefits of the "salon de l'automobile" held regularly in Paris, and expressed the hope that "le salon de l'automobile électrique de Boston" might prove to be a pleasure to the public and a profit to the exhibitors.

During the salon attractive electric signs announcing the event were installed in the hotel. The Tenney companies, operating about thirty-one public utilities in various Eastern muncipalities, provided a woman demonstrator, who introduced prospective customers to the exhibitors and also explained her personal experience in electric automobile operation.

Superintendent W. H. Atkins, of the Boston Edison Company, gave a luncheon on Tuesday noon to a number of prominent electrical men identified with the central-station industry in eastern Massachusetts.

Mr. Arnold on Chicago Terminal Electrification

At a meeting of the committee on railway terminals of the Chicago City Council, Nov. 18, Mr. B. J. Arnold made public his report on a plan of rearrangement and development of the steam-railroad terminals of Chicago. The report, which had been previously submitted to the citizens' terminal-plan committee, makes a book of 237 printed pages with many diagrams and maps and was prepared within sixty days. It is commented upon as being a remarkable document to have been compiled in such a comparatively short space of time.

In his report Mr. Arnold reviews the proposals of Mr. John F. Wallace on the subject of railway terminals, presented to the Council committee Oct. 20. Mr. Wallace had recommended that the plans of the Pennsylvania Railroad for a new union passenger terminal be adopted and that the same company's scheme for a freight terminal be accepted with some modifications. Mr. Arnold has gone into the same subject much more extensively, and instead of mild acceptance of the railroad companies' demands asks for their co-operation in the extension of terminal facilities along certain lines which he lays down. These provide among other things for the straightening of the South Branch of the Chicago River and for the placing of all tracks in covered subways beneath the street level in the district bounded by Lake Street, Halsted Street, Twelfth Street and Lake Michigan.

Long-distance passenger traffic, it is urged, should be concentrated into the fewest number of terminals practicable, and details of arrangement are suggested. The city plan of Chicago should be supported, continues Mr. Arnold, and the passenger terminal plans co-ordinated with the local street-railway facilities, including the proposed subways. The improvements suggested in the report would practically necessitate electrification of the tracks, nevertheless this view is not introduced as an attempt to force electrification, for Mr. Arnold says that nearly all progressive steam-railroad men recognize that electrification of terminals must come within a reasonable time. Electrification will enable the railroads to effect an enormous real-estate development of their terminal property.

The report will be considered further at a meeting of the railway terminals committee to be held Nov. 25. Mr. Wallace, Mr. Arnold and representatives of both the citizens' terminal-plan committee and the Chicago plan commission have been invited to sit with the committee. Certain employees of steam-railroad companies who have vigorously opposed the proposed electrification have been assured that they may also have representatives present when the subject of electrification comes up. Following Tuesday's meeting, many aldermen left for the East to study subways and terminals.

Activities of E. V. A.

President Frank W. Smith of the Electric Vehicle Association of America addressed the New England Section of the organization and the Electric Motor Car Club of Boston, at a joint meeting at the Hotel Thorndike, Boston, on Nov. 14, about seventy-five members and guests being present. He emphasized his intention to lead the association to fields of larger influence during his coming administration, paid tributes to the pioneer work of Messrs. W. H. Blood, Jr., and C. L. Edgar, of Boston, in furthering the electric-vehicle cause, and commented upon the growth of membership, which now aggregates 500. Mr. Smith spoke in enthusiastic terms of the recent Chicago convention and pointed out that more than forty new members were added at that time. Since the convention a number of additional applications have been received, including an important central station not previously in membership, with four associate and several press members. The increase has been 57 per cent since the 1912 convention.

At the meeting of the organization on Nov. 25 in New York action will be taken upon the petition of the proposed Philadelphia section for formation. The proceedings of the convention, not including the ten papers read, cover 250 closely typewritten pages. Three thousand copies of the official report of the convention will be published for distribution to members and others interested, and the proceedings will be further reviewed at section meetings this winter. All suggestions made on the floor have been tabulated for early consideration, and work by committees is to be the keynote of the year's program of development, along the lines successful in the N. E. L. A. Mr. Joseph F. Becker, of the United Electric Light & Power Company, New York, has been appointed chairman of the committee on membership and formation of sections, his work as chairman of the membership committee of the Commercial Section of the N. E. L. A. and as New York statesman of the Jovian Order specially fitting him for the task. The slogan for the year will be "Double the membership in twelve months."

An important constructive suggestion was offered by President Smith in the recommended formation of a committee on central-station co-operation, whose function it will be to determine exactly to what degree central stations and manufacturers are working together and what is lacking in such endeavors in the electric-vehicle field. Such a committee would present at the next convention a report that would answer once and for all the question as to the extent of this co-operation and how the conditions had been improved or otherwise during the period. The speaker stated that, although the association is fortunate in the willingness of Secretary Harvey Robinson to serve another year, the problem of securing a paid secretary giving his entire time to the work with permanent headquarters must soon be faced. New committees are also desirable upon the subjects of traffic, good roads and relations with the Commercial Section of the N. E. L. A., the last-named in particular connection with publication of electric vehicle data in the "Salesman's Handbook." Closing, the president described the booklets on commercial and pleasure vehicles just issued by the association.

New Chicago Requirements for the Mitigation of Electrolysis

As related in the *Electrical World* of Nov. 1, page 888, the local transportation committee of the City Council of Chicago, after an animated hearing, recommended an ordinance providing for the unified operation of the surface street-railway lines in Chicago, containing, among other things, a section materially modifying the existing ordinance intended to prevent electrolytic damage from grounded railway return circuits. The section was adopted by the City Council and agreed to by the company.

By the proposed ordinance the city would be divided into three zones—an inner or congested-traffic section, a middle zone taking in the thickly populated residence sections, and a third or outer zone bounded by the city limits. All uninsulated return circuits shall be of such current-carrying capacity and so arranged that the sustained maximum difference of potential between any two points shall not exceed 10 volts in the inner zone, 15 volts in the middle zone and 20 volts in the outer zone. Moreover, such differences in potential shall not exceed limits to be from time to time prescribed by the Board of Supervising Engineers, Chicago Traction, thus giving the board power to install a potential gradient. The board may also increase the limit in the outer zone to 25 volts where underground utilities are not fully developed.

The Board of Supervising Engineers is to make tests to determine whether the companies are complying with the ordinance, the companies installing the necessary apparatus. The rate of progress of the work of electrolysis prevention is prescribed by the section, and within two years from the date of passage of the ordinance its provisions shall have been complied with throughout their entire railway systems by the expenditure of $1,000,000 if deemed necessary by the Board of Supervising Engineers, or more if necessary to prevent electrolytic damage.

Fines of from $50 to $200 a day are provided for each day's operation contrary to the provisions of the ordinance. A "Board of Electrolysis Claims," to consist of the city electrician, the chairman of the Board of Supervising Engineers and an engineer to be appointed by the street-railway companies, will hear and determine all electrolysis claims. Decisions of this board will be final and binding on the companies and on the municipal corporations. Within thirty days after the board has rendered its decision on any claim the company causing electrolytic damage shall pay to the municipal corporations entitled thereto the amount fixed.

Rate Revision Ordinance Now Pending in Chicago City Council

After the whole matter of revising the rates of the Commonwealth Edison Company was left in the air by the Chicago City Council committee on gas, oil and electric light on Nov. 10, as related last week, the committee held its next meeting on Nov. 12. It will be remembered that the committee by a vote of 3 to 8 refused to adopt Section I of the proposed ordinance containing the provisions for rates for general consumers. At the meeting of Nov. 12 the action taken was reconsidered and discussion of the section was resumed. Mr. William H. Arthur, counsel for the Commonwealth Edison Company, said that the company would not accept less than a five-year contract for rates lower than 10 cents primary, 5 cents secondary and 4 cents tertiary, to go into effect on Dec. 1, 1913, the tertiary rate to be reduced to 3 cents on March 1, 1914. Mr. Ray Palmer, the city electrician, dwelt on the importance of the proposed contract ordinance in enabling the city to extend its street-lighting service. The proposed ordinance is fair and reasonable, Mr. Palmer said, and he recommended it. Alderman Merriam renewed his objections, based largely

on the advice of Mr. E. W. Bemis, the public-utility expert. He said the city should have some concessions, either on the reduction of the primary rate or in reducing the term of the contract. Mr. W. J. Norton, speaking for the company in relation to the reduction of the primary charge from 10 cents to 9 cents, said that it is true that the company, in serving perhaps 20,000 of its small lighting customers, would do so at a loss at either rate. It might be assumed that the cost of supplying these small short-hour customers was about 15 cents per kw-hr., but the rate to be adopted between 15 cents and zero must be a reasonable one or it would not be upheld by the courts. The company contends that 10 cents is a reasonable maximum rate.

Alderman George H. Bradshaw moved that Section I of the ordinance be adopted with the addition of Alderman M. J. Healy's amendment providing that the company shall pay the established prevailing organized-labor scale of wages for any construction work that may be done by it in extending street-lighting service for the city. This motion prevailed by a vote of 8 to 7. After this there was comparatively clear sailing in the committee, and the ordinance was adopted section by section substantially as recommended by City Electrician Palmer and agreed to by the company. In relation to the Healy amendment Mr. Arthur said that he was not in position to say whether the company would accept it or not. Finally the whole ordinance, as amended, was recommended to the City Council for passage by a vote of seven to four.

The ordinance as recommended was introduced in the Council Nov. 13. It was ordered published and made a special order for the meeting of Nov. 24.

Credits and Collections Discussed by Electrical Business Men

For the purpose of exchanging information in relation to the credit rating of customers, the Electrical Credit Association of Chicago is active the year round, its territory extending from Pittsburgh on the east to Denver on the west and from the Canadian line to the Gulf of Mexico. The work is effected through the office of the secretary, Mr. Frederic P. Vose, who has supervision of the actual work of the association under the guidance of the officers and executive committee. Once a year the association has a "round-up," held this year on Nov. 14. The attendance at the afternoon business meeting was about eighty, and for the first time women were present, one of them reading a paper before the association.

Work on the Chicago Association

In his address the retiring president, Mr. S. E. Kennedy, Central Electric Company, Chicago, said that while nearly all the reputable jobbers and dealers are members of the association, a large opportunity still exists for securing new members among the manufacturers. Mr. F. M. Pierce, Manhattan Electrical Supply Company, Chicago, representative of the association on the board of the National Electrical Credit Association, next made a brief report.

Mr. Vose presented his report as secretary and treasurer. The Chicago association was organized in 1896 and has now 215 company members, about one-third of whom are in the city of Chicago. In 1913 there were 6723 claims of delinquent debtors reported to the association. The amount involved was $570,011.37. The number of claims settled through the incidental activities of the association (which is not a collection agency) was 4265, representing $355,525.08. The ratio of number of accounts settled to total number reported to the association was about 63 per cent. Since the organization of the association the estimated amount received in settlement of accounts as an incidental result of its activities is about $3,680,000.

Election of Officers and Other Business

Mr. Henry Schwab, Monarch Electric & Wire Company, Chicago, reported as the chairman of the membership committee and offered a resolution, which was adopted, providing for the creation of territorial committees in trade centers.

On the recommendation of the nominating committee, of which Mr. J. N. MacAlister, Chicago, Simplex Wire & Cable Company, was chairman, the following officers were elected: President, Mr. A. O. Kuehmsted, Gregory Electric Company; vice-president, Mr. Henry Schwab, Monarch Electric & Wire Company; national representative, Mr. F. M. Pierce, Manhattan Electrical Supply Company; members of executive committee, Messrs. E. R. Gilmore, Western Electric Company, and S. E. Kennedy, Central Electric Company.

Co-operation Between Sales and Credit Departments

Three papers were read on "Co-operation Between Sales and Credit Departments." Mr. A. J. Gaehr, Cleveland, George Worthington Company, said that each salesman should consider himself a member of the staff of the credit department. On the other hand, the credit man should take the salesman into his confidence and teach him how to analyze financial statements. Further, the credit man should be alert to help the customer. Miss Elizabeth M. Smith, Chicago, who is the credit manager of the Bryan-Marsh Electric Works of General Electric Company, read the next paper on this subject. She made the point that co-operation should not be all on the part of the salesman. The latter, however, should never apologize for letters from the credit department. A customer never gets a collection letter without reason. She argued also that the credit man and the salesman ought to be on the same basis of compensation. If, for instance, the salesman is paid a commission or a salary and bonus, the credit man should be paid in like manner. Every order placed before a credit manager should mean either a personal gain or loss to him. Mr. W. H. Fogarty, Chicago, H. W. Johns-Manville Company, read the last of the three papers, dwelling on the importance of team work.

Elimination of Cash Discounts

A letter was read from Mr. Henry L. Walker, Detroit, Henry L. Walker Company, in which he made a plea for the elimination of the cash discount. All sales should be made net at thirty days. After the lapse of ninety days no more goods should be sold to the customer and the account should be considered delinquent. Mr. E. R. Gilmore said that cash discounts are a source of evil from start to finish. Mr. Charles G. Burton, Peru (Ind.) Electric Company, favored eliminating the cash discount. Mr. Frank Horton, Chicago, Moran & Hastings Manufacturing Company, urged the prompt reporting of delinquent accounts, and Secretary Vose at this point made a strong plea for reciprocity among members. On motion of Mr. Miner it was voted to be the sense of the meeting that cash discounts be eliminated. While this resolution was under debate Mr. A. O. Kuehmsted quoted Mr. Roger Babson, who has said that the "discount thief" is a public nuisance.

Moral Risk Clubs

Mr. W. J. Burton, Frank Adam Electric Company, St. Louis, described the recently established Moral Risk Club in St. Louis. The club is patterned after the ones in Chicago and other cities. Where credit is based on the buyer's general reputation for honesty and business ability co-operation between sellers prevents them from being victimized by dishonest men. Mr. Burton recommended the formation of such a club in any city where six or eight members can be secured. The cost in St. Louis is only $6 a year to each of the twelve members. Mr. Thomas J. Creaghead, Cincinnati, Creaghead Engineering Company, said that two members could organize a moral risk club.

Public Service Commission News

INDIANA COMMISSION

Criticism that has arisen because of the unprecedented stand of the new Indiana Public Service Commission in acting as an arbitration board for the settlement of the strike difficulties on the lines of the Indianapolis Traction & Terminal Company and several interurban systems has been considered carefully by the Governor and members of the commission. They say they realize that they are treading on dangerous ground, but that the crisis which called for action was so imminent and the lack of an arbitration board was so apparent that eventually the question came to whether the commission should attempt to solve the difficulty as individual arbiters and not by any authority of law or with any attempt to enlarge the powers of the board or whether the Governor should call a special session of the Legislature to pass a law creating an arbitration board.

The latter step was practically impossible because of the depleted condition of the state treasury, and then it was decided that, with the greatest care to avoid establishing a precedent, the commission members should tender their services until the 1915 session of the Legislature could establish a proper board. Both the Governor and the members of the commission are resisting every attempt to make the action of the commission appear as other than an emergency position, and all agree that the commission has no place in arbitration.

Developments of the past few days show what a pressure is being brought on both sides of the controversy to compel a settlement of the differences without resort to the commission. For a time it appeared that all the grievances of the men would be taken care of by the companies without the aid of that body. Later it was said that one or two of the more serious contentions might be taken to the state body for solution. The Governor and his aids have been working strenuously to keep even these from going before the utility commission if possible.

MISSOURI COMMISSION

Testimony has been presented before the Missouri Public Service Commission in the case involving electric rates of the Springfield (Mo.) Gas & Electric Company. Engineers submitted reports on appraisals of the physical property for the commission and the company. Testimony was also offered in reference to other elements of value than the physical property. Mr. W. J. Squires, of Squires & Company, Kansas City, Mo., made a report for the commission showing a reproduction value of the physical property of $403,650. Mr. F. P. Woy, Albuquerque, N. M., submitted an estimate on behalf of the company showing a total cost of the property of $515,390. Mr. W. G. Woolfolk, of Sanderson & Porter, New York, showed a reproduction value of $508,675.

The direct issue involved in the case is that of the maximum rate for residence lighting. The company has been charging a maximum rate of 15 cents per kw-hr. less a discount of 10 per cent for prompt payment. Negotiations, however, have been under way in reference to rates and the company offered to reduce its maximum to 12 cents. Citizens who brought the case before the state commission have asked for a rate of 6 cents. The company has recently made a contract with the Ozark Power & Water Company for power. In view of this arrangement it uses its old steam plant only for reserve purposes. One of the questions arising in the hearing was over the value of the reserve steam plant. The company claimed that this plant was of great value for reserve purposes and was a necessary and material part of its investment.

Mr. E. M. Stephens, of Kansas City, Mo., representing the citizens who commenced the proceedings, testified regarding the cost of construction of an equivalent plant.

Mr. Henry Floy, of New York, checked up the values fixed by the engineers and, starting with a physical value of $500,000, added sums for preliminary organization and promotion expenses, going value and taxes and interest during construction. He declared that the operating expense charges were reasonable and emphasized the necessity of maintenance of the steam plant for reserve purposes. Mr. Floy presented a number of exhibits, including one giving a record of various causes of interruptions of service to two terminal houses of the Cataract Power & Conduit Company, Buffalo, N. Y., from Jan. 1, 1907, to Aug. 1, 1913. The total numbers of interruptions by years were as follows: In 1907, sixteen interruptions, 153 minutes; 1908, nine interruptions, 68 minutes; 1909, fourteen interruptions, 119 minutes; 1910, sixteen interruptions, 120 minutes; 1911, twenty-eight interruptions, 216 minutes; 1912, eighteen interruptions, 138 minutes; Jan. 1 to Aug. 1, 1913, nineteen interruptions, 177 minutes. The totals for this period were 120 interruptions and 991 minutes.

Mr. Edwin Gruhl, assistant to the president of the Milwaukee Electric Railway & Light Company, testified on going value and depreciation.

Mr. W. H. Blood, Jr., of Stone & Webster, testified that he had found going value to be about 25 per cent of the structural cost. He also discussed working capital.

Mr. A. C. Einstein, general manager Union Electric Light & Power Company, of St. Louis, in referring to the necessity for a reserve plant said that if he knew he could avoid interruptions of service at St. Louis for one minute he would not hesitate to spend $100,000 for that purpose.

Mr. Charles S. Ruffner, Electric Company of Missouri; Mr. L. C. Gerry, Federal Light & Traction Company; Mr. E. D. Smith, Mississippi River Power Distributing Company; Mr. Francis Blossom, of Sanderson & Porter; Mr. George D. Coaney, of A. G. Edwards & Company, bankers of St. Louis, and Mr. R. E. McDonnell, of Burns & McDonnell, Kansas City, Mo., also appeared as witnesses.

Current News Notes

TO PATROL TRANSMISSION LINES BY AEROPLANE.—From San Francisco comes an announcement that Robert Fowler, the aviator who recently completed a cross-continental flight, has arranged with a California transmission company to patrol its high-tension lines leading out of Oakland in an aeroplane. A lineman equipped with repair apparatus will ride with the aviator, and the pair will take trips twice a week. The headquarters of this novel inspection crew are to be established at Sacramento.

* * *

CHICAGO SUBWAY PROJECTS.—The City Council of Chicago has asked for bids on the construction of a system of comprehensive passenger railway subways. The Board of Harbor and Subway Commissioners has estimated the cost at about $130,000,000. According to the present plan, bids are to be received until Jan. 5, 1914, and then opened publicly. The comprehensive plan of subway construction, the Arnold plan of limited subway construction, and possibly others, will probably be submitted to the voters at the election in April so that they may indicate their preference.

* * *

EXAMINATION FOR EXAMINER, PUBLIC SERVICE COMMISSION.—The New York Public Service Commission, Second District, Albany, N. Y., has vacancies for an examiner at a salary of $1,801 to $2,400, with expenses when engaged in field work, and for an assistant examiner at a salary of from $1,501 to $1,800. Examination for both of these positions will be held the latter part of November. Practical experience in corporation accounting for steam railroads, street and electric railways, electrical corporations, gas companies or telephone and telegraph companies is necessary. Candidates must be between the ages of twenty-five

and thirty-five. The examination is open to non-residents of New York State. For application blanks address State Civil Service Commission, Albany, N. Y.

* * *

Fessenden High-Frequency Patent Injunction.--Judge Rellstab in the Federal District Court at Trenton, N. J., on Nov. 17, issued an order enjoining the Marconi Wireless Telegraph Company of America against further infringement of the Fessenden high-frequency patents, but permitting the company to deliver radio apparatus to the United States Navy by giving suitable bond pending an appeal from the injunction. The Fessenden patents, which are owned by the National Electric Signaling Company, were described on page 939 of our issue of Nov. 8.

* * *

Booklets in Electric Vehicle Association's Publicity Campaign.—Two handsomely illustrated booklets—"The Story of the Electric Pleasure Vehicle" and "The Story of the Electric Commercial Car"—have been issued by the Electric Vehicle Association of America for use in its publicity campaign. Between striking colored covers, measuring 8 by 11 in. much interesting general information on electric-vehicle subjects is given in attractive popular form, detailing the advantages, costs, safety, simplicity and economy of their operation. No particular make of vehicle is emphasized in either booklet, but a number of cars of representative manufacturers are illustrated and described, the features of each being pointed out. The text pages are of heavy calendered paper and are profusely illustrated, with marginal designs in special tints. Data comparing the relative operating cost of horse and electric propulsion are a feature of the commercial-vehicle pamphlet. Central-station companies, accessory manufacturers, etc. are invited to order and use these booklets in their own publicity work. For the first issue the price will be 25 cents per copy, but with future orders it is likely that this cost will be reduced. The booklets are being sold at actual cost by the association. The headquarters of the publicity committee of the Electric Vehicle Association are at 1170 Broadway, New York City.

* * *

SOCIETY MEETINGS

American Museum of Safety.—In connection with its annual meeting in New York, the American Museum of Safety will serve a dinner at the Waldorf-Astoria on Dec. 12. Mr. George F. Kunz is chairman of the dinner committee, which includes also Messrs. George B. Cortelyou, Elbert H. Gary, James Speyer and William H. Tolman.

* * *

Colorado Electric Club.—At the weekly luncheon of the Colorado Electric Club held at the Albany Hotel, Denver, Nov. 13, Gov. E. M. Ammon addressed the club on the subject of "Conservation." For the following Thursday noon the speaker of the day was scheduled to be President Haldane of the Colorado School of Mines at Golden.

* * *

Electric Vehicle Association of America.—The regular monthly meeting of the Electric Vehicle Association of America will be held Tuesday evening, Nov. 25, in the Engineering Societies Building, New York City. "The Industrial Truck as a Factor in the Efficient Handling of Internal Freight" is the title of a paper to be presented by Mr. W. W. White, of the General Vehicle Company.

* * *

Detroit Contractors Dine.—In honor of President Ernest Freeman and Secretary G. H. Duffield of the National Electrical Contractors' Association, who came to Detroit to make arrangements for the national convention to be held there next June, the local members of the contractors' association gave a banquet Nov. 10 at the Hotel Cadillac. Mr. L. W. Eddy acted as toastmaster, and responses were made by Messrs. E. McCleary, W. Turner, J. N. Rabe and T. Templeton. The Michigan section of the contractors' association will hold a meeting at Saginaw Dec. 15, to select delegates for the Detroit convention.

* * *

Toledo Section, A. I. E. E.—The regular monthly meeting of the Toledo Section, American Institute of Electrical Engineers, was held Nov. 7 at the Commerce Club, Toledo, Ohio. Mr. H. R. Fowler, of the Fowler Electrical Supply Company, read a paper on "The Electrical Control of Bridges." The members then adjourned and in a body inspected the bascule lift of the Cherry Street bridge recently mentioned in these columns.

* * *

High-Tension Transmission.—Mr. P. H. Thomas, consulting engineer of New York City, delivered an address before the Yale Branch of the American Institute of Electrical Engineers at its regular meeting in the new electrical engineering laboratory of the Sheffield Scientific School on Nov. 12, 1913. The subject presented by Mr. Thomas was that of high-tension transmission, which was discussed in its various mechanical and electrical aspects.

* * *

Yonkers (N. Y.) Branch, N. E. L. A.—The Yonkers (N. Y.) Electric Light & Power Company Branch of the National Electric Light Association held its first meeting Nov. 10, and elected Mr. G. B. Cornell president and Mr. E. J. Reilly secretary. During the evening addresses were made by President-elect Cornell on "Electricity on the Farm," Rev. F. W. Cutler on "Co-operation and Organization," and Mr. W. Donshay on association matters.

* * *

Pittsburgh Section, A. I. E. E.—Mr. F. R. Phillips, superintendent of maintenance of the Pittsburgh Railways Company, read a paper on "Recent Developments in Cars and Equipment of the Pittsburgh Railways Company" before the last monthly meeting of the Pittsburgh Section of the American Institute of Electrical Engineers. Mr. J. W. Welsh, electrical engineer of the company, collaborated with Mr. Phillips in the preparation of the paper.

* * *

N. E. L. A. Committee on Wiring of Existing Buildings.—The National Electric Light Association's committee on the wiring of existing buildings, of which Mr. R. S. Hale, Boston, Mass., is chairman, met at New York Nov. 19 and formulated plans for furthering the collection of data on wiring and the compilation of commercial practices. Among the topics discussed during the all-day session were methods of handling the business of very small consumers by European central stations.

* * *

Professor Muensterberg on "Human Efficiency."—Dr. Hugo Muensterberg, of Harvard University, spoke before the students of the New York Edison Company's commercial school Nov. 19, on the subject "Applying Psychology to Business." The speaker emphasized the part played by suggestion in every-day affairs, particularly in the work of the salesman. He made a plea for better analysis of the student's fitness for his intended vocation and suggested direct methods for studying mental applicability.

* * *

Illumination Topic Before the Froebel Society.—At the regular monthly meeting of the Froebel Society of Brooklyn, N. Y., to be held at Pratt Institute Assembly Rooms, 215 Ryerson Street, Brooklyn, Tuesday, Nov. 25, at 2:30 p. m., Mrs. Preston S. Millar, wife of the past-president of the Illuminating Engineering Society, will present a paper on "The Illumination of the Home." The influence of light in conserving vision and in beautifying the home will be discussed, and the paper will be illustrated by means of miniature rooms illuminated according to the principles of good lighting.

Operating Data of a Large Railway Power Plant

Development of generating system of Twin City Rapid Transit Company, Minneapolis—Unit costs with water-power, steam engines and steam turbines—Increasing the efficiency

FOR a long time the Twin City Rapid Transit Company, of Minneapolis and St. Paul, Minn., has been devoting careful study to its problems of power generation. The high price of coal in Minneapolis furnishes a special incentive for the introduction of efficient steam-plant apparatus, as well as for the utilization of the water-power available in the falls and rapids of the Mississippi River at this point. This hydraulic energy is not, however, sufficient to supply all of the power required by the system, for several local flour mills possess prior rights to a considerable part of the available falls. The generating system of the Twin City company therefore at present consists of three quite modern plants, one a steam station and the other two operated by water-power. The first-mentioned is now equipped with steam turbines practically throughout, and nearly ten years ago replaced the older plants with their slow-speed belted units.

That the efforts to reduce generating expenses have been successful is evident from the reduction in fuel cost from about 0.7 cent per kw-hr. in 1905 to about 0.4 cent in 1913. At the same time labor and superintendence costs were reduced from 0.09 cent to 0.06 cent, and the outlay for lubricants and waste from 0.01 cent to 0.001 cent per kw-hr. This reduction has been accomplished by gradual improvement of the present steam plant and by economy in its operation. Before 1905 conditions were even worse, as shown by the 1901 total operating cost, about 1.4 cents per kw-hr., of which fuel was the principal item. At this time several old-fashioned steam plants were in operation supplementing the output of one water-power station.

Early Water-Power and Steam Plants

Before 1897 the old steam stations just referred to were the sole source of power, but in that year a water-power plant was built at St. Anthony Falls, in Minneapolis, by the Pillsbury-Washburn Company and later taken over by the St. Anthony Falls Water Power Company. It contains eight 700-kw, three-phase, 3450-volt waterwheel-generator units and two 700-kw, 650-volt direct-current units, besides two waterwheel-driven exciters. Under the same roof there is also a substation with four 600-kw rotary converters. The alternating-current output is stepped up to 13,200 volts for transmission. The full flow of the Mississippi River, varying from 3000 cu. ft. to 15,000 cu. ft. per second or more, is utilized in this plant, the load on which for a long period has averaged over 4000 kw during the entire

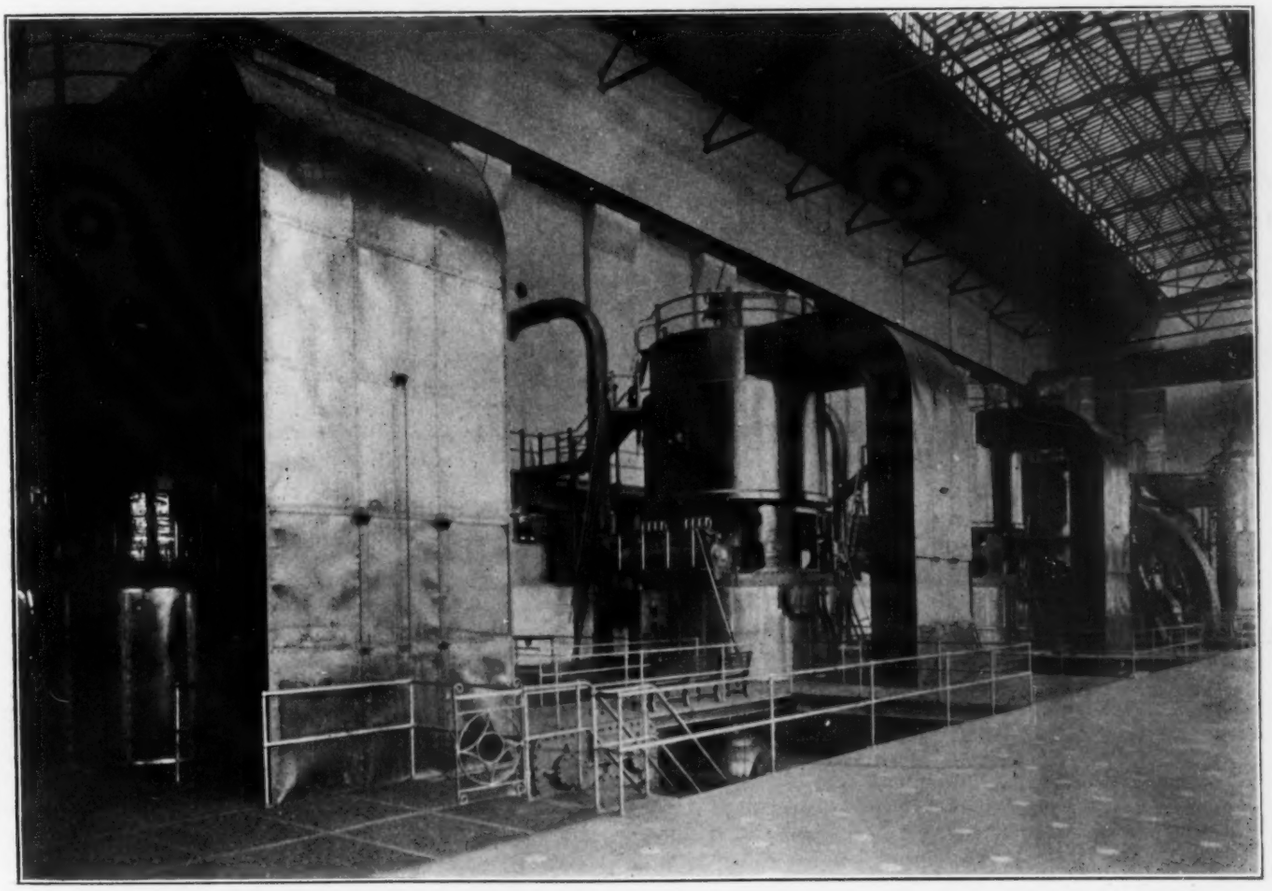


FIG. 1—INTERIOR OF TURBINE ROOM, TWIN CITY RAPID TRANSIT COMPANY'S PLANT, MINNEAPOLIS, MINN.

year. The station was for a time the main dependence of the Minneapolis traction system for its power supply.

Such good service was furnished by the "lower dam" station that a few years ago a second one was built at the "upper falls" to develop the extra power not required by earlier users. This development, known as the Hennepin Island plant, was inexpensively constructed, since the existing hydraulic works were utilized as far as possible and much of the required building material was found on the site. The cost was stated to be not over $26 per hp. The plant contains four 2250-kw, 13,200-volt, 35-cycle, three-phase generators and two 150-kw exciters, together with an entirely modern oil-switch and measuring equipment. The station was put into service in June, 1908, and has since utilized the surplus water to excellent advantage. While its output is necessarily very fluctuating and, unfortunately, does not reach its maximum when power is most needed, in the early summer, it carries about one-third of the entire load.

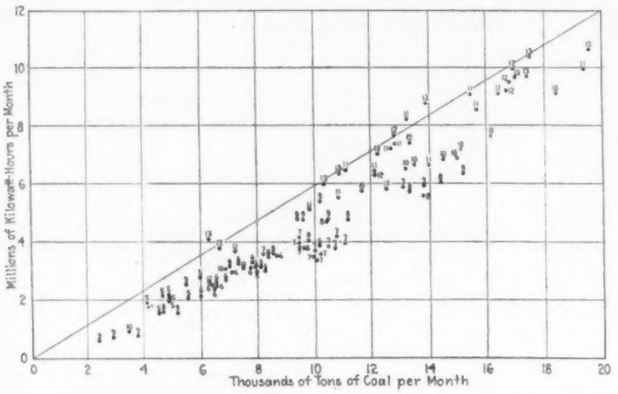


FIG. 2—RELATION BETWEEN OUTPUT AND COAL CONSUMED

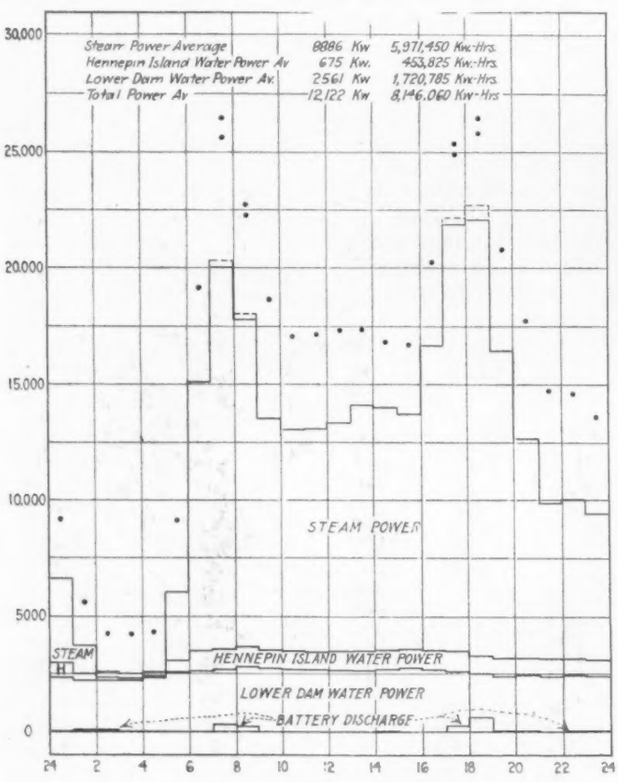


FIG. 3—SYSTEM LOAD CURVE FOR FEBRUARY, 1909

Although the water-power plants are economical, they have limited capacity, and to an increasing extent in the future must steam be depended upon. Ten years ago a modern steam plant was projected for the site close to the lower-dam hydraulic plant. It was designed to contain ultimately five vertical, cross-compound Allis-Chalmers engines of 5000-hp capacity, direct-connected to three-phase, 13,200-volt, 35-cycle General Electric generators rated conservatively at 3500 kw, or, with the present standard temperature rise, 4000 kw. Three of these engines had been installed by 1905, giving the plant an actual rating of 12,000 kw.

The engines were supplied with steam from a boiler room containing eighteen Babcock & Wilcox boilers, each with 5560 sq. ft. of heating surface and a nominal rating of 556 boiler hp. These units were equipped with Roney stokers rated for continuous fuel supply at 825 hp, in order to develop 50 per cent overload on the boilers. Superheaters provided developed 120 deg. superheat at rated load. Draft was furnished by two Custodis radial-brick stacks, rising 225 ft. above the boiler-room floor.

There were four coal bunkers of I-beam and cinder-concrete construction located above the boilers and having an aggregate capacity of 2800 tons. These bunkers were supplied with coal by means of a complete conveyor system consisting of a receiving track for coal cars at one side of the building and a belt conveyor into which coal could be shoveled from the cars running between one wall of the building and the track. Driven by a 10-hp motor was a crusher fed from a hopper into which the belt conveyor discharged. An overlapping gravity-type bucket conveyor belted the boiler room transversely, and two distributing bucket conveyors above the row of bunkers belted the boiler room longitudinally. The lower runs of the last-named conveyors were also designed for ash removal, the ash hoppers discharging directly into them.

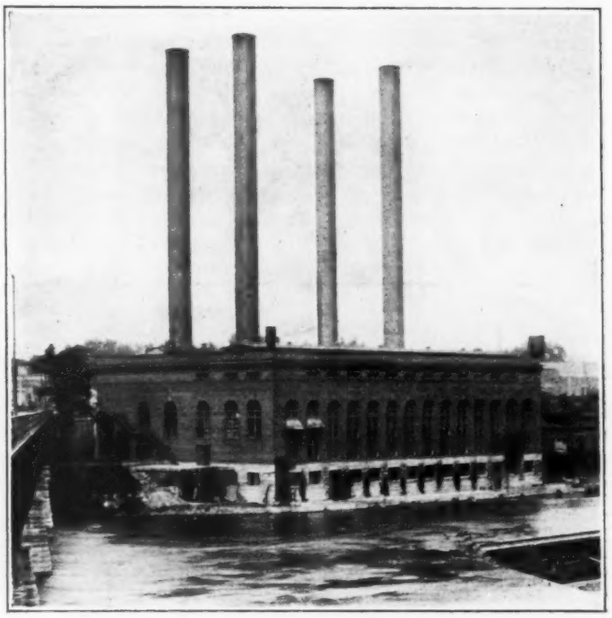


FIG. 4—STEAM STATION AND WATER-POWER DAM, MINNEAPOLIS, MINN.

First Use of the Steam Turbine

Following the original plan, a fourth engine and eight more boilers were added in April, 1906. By this time, however, the steam turbine had been pronounced a success at Chicago and elsewhere, and in place of the fifth engine two 5000-kw Curtis vertical turbines were installed in February and July, 1907, respectively. The fact that this space accommodated in turbines three times its rating in engines is significant. No increase in boiler capacity was made at the time. A complete detailed account of the plant as it

existed in its earlier years was given in a paper presented by the mechanical and electrical engineer of the company, Mr. E. H. Scofield, before the Minnesota Branch, A. I. E. E., in December, 1906.

As already noted, the plan for the station was modified radically before it was completed. Hardly had the new turbines been installed when it was found possible to secure larger and more economical ones, and the process of replacing the engine units began. In the meantime experiments had been made with chain-grate stokers, and in January, 1909, two were installed; in July four others, and during the fall six more. To improve the capacity and efficiency of the chain-grate stokers better draft was required and one of the brick stacks was accordingly replaced in November, 1910, by two brick-lined steel ones mounted on structural-steel frames. These are 200 ft. high with flue diameter of 14 ft. The first 14,000-kw vertical Curtis turbine unit was put into service in February, 1911, and in July six more chain grates were installed. The space

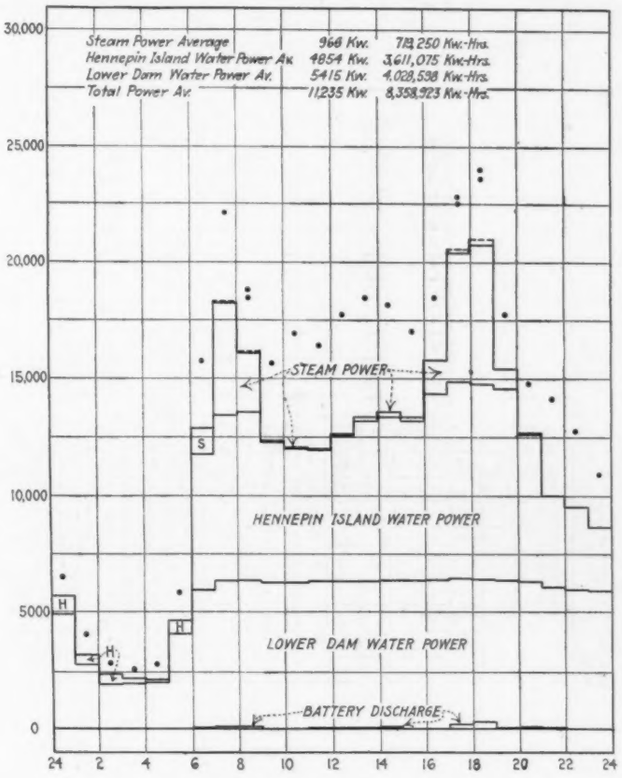

Steam Power Average 968 Kw. 712,250 Kw.-Hrs.
Hennepin Island Water Power Av. 4854 Kw. 3,611,075 Kw.-Hrs.
Lower Dam Water Power Av. 5415 Kw. 4,028,598 Kw.-Hrs.
Total Power Av. 11,235 Kw. 8,358,923 Kw.-Hrs.
STEAM POWER
HENNEPIN ISLAND WATER POWER
LOWER DAM WATER POWER
BATTERY DISCHARGE
30,000
25,000
20,000
15,000
10,000
5000
0
24 2 4 6 8 10 12 14 16 18 20 22 24

FIG. 5—SYSTEM LOAD CURVE FOR MAY, 1909

occupied by the masonry stack foundations was utilized for the installation of two additional boilers of 5000-sq. ft. heating surface, and the remaining furnaces were equipped with chain grates. The second brick stack was replaced with two steel ones in August, 1912. During the following month the first 15,000-kw turbine set displaced another engine. More steaming capacity being required, two more boilers were added in January, 1913, being installed in the space previously occupied by the foundation of the second brick stack. As this issue of the *Electrical World* goes to press the installation of the third large turbine has just been completed and but one engine of the original four remains.

The most conspicuous results of this evolution of the Twin City plants are seen in the increased station capacity in a given space and in reduced operating costs. As originally planned the capacity of the station was not over 20,000 kw. In the same space the present capacity is 60,000 kw, and it will be still further increased when the last engine unit is replaced. The effects of the changes in energy costs have already been touched upon but will be taken up in more detail. Fortunately the company keeps very accurate records, enough of which are reproduced in the accompanying figures to permit a study of the gradual cost reduction.

Results of the Use of Economical Generating Units

In Fig. 2 are given the results of a study just completed by Mr. Scofield, engineer for the company, covering the

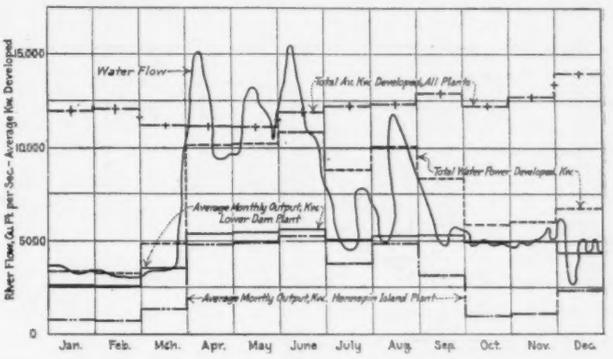

Water Flow
Total Av. Kw. Developed, All Plants
Total Water Power Developed, Kw.
Average Monthly Output, Kw., Lower Dam Plant
Average Monthly Output, Kw., Hennepin Island Plant
River Flow, Cu. Ft. per Sec. - Average Kw. Developed
15,000
10,000
5000
0
Jan. Feb. Mch. Apr. May June July Aug. Sep. Oct. Nov. Dec.

FIG. 6—RIVER FLOWAGE AND OUTPUT OF STATIONS DURING 1909

relation of the rate of coal consumption to the rate of energy production. A straight line drawn with a slope corresponding to 3.5 lb. of coal of an equivalent thermal value of 10,000 lb.-Fahr. heat units per lb. indicates the best average performance yet secured. The dots, numbered to correspond with the years from 1905 to date, indicate the monthly averages for the entire period of the station's existence. The remarkable effect of the newer units extends even to the small outputs, for which the load-factors are smaller as the size of the plant increases. Thus in 1913, with an output of but 4,125,000 kw-hr., the record of 3.03 lb. per kw-hr. was reached. In 1905 the same output was produced at the rate of 4.75 lb. per kw-hr.

It will be remarked that this same output required more coal in 1907 and 1908, but in these years the station was larger and therefore the same output represents a lower load-factor. In June, 1907, when the load-factor was a maximum for that year, the coal rate was 4.45 lb. per kw-hr. To comprehend fully the significance of this result it is necessary to study the steam-station load charts given

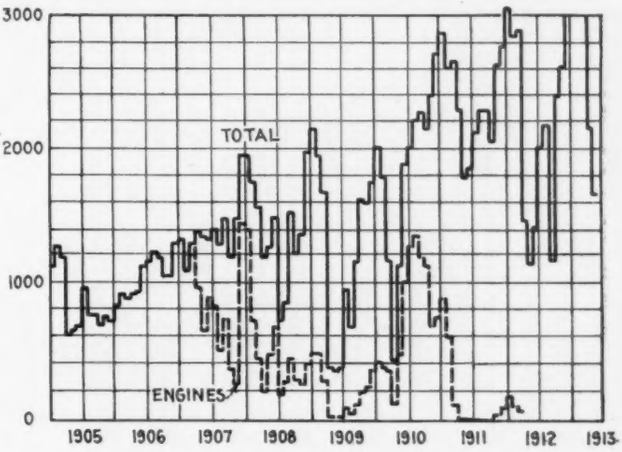


FIG. 7—CHART SHOWING ENGINE-HOURS AND TURBINE-HOURS

in the accompanying figures. In connection with them the water-power-plant charts are also of interest.

Station Records

Fig. 6 shows the river flowage for the year 1909 and the corresponding outputs of the two water-power plants and of all of the plants together. The maximum monthly average load on the steam plant, 8886 kw, occurred in February

and the minimum, 966 kw, in May. Average daily load charts for these months are shown herewith in Figs. 3 and 5. The dots on these charts represent the maximum loads on the system and on the stations, without the battery.

The very instructive charts reproduced in the other accompanying curves contain a complete graphical record of the most important operating features of the Twin City Rapid Transit Company for the past eight and one-half years. Fig. 12 shows the great saving in cost due to the use of water-power, for when the cost of steam power is small, as shown in the lower part of the figure, indicating a good water supply, the total cost, as given in the upper graph, is also low, although the actual monthly energy output is practically constant. The steam-plant load is seen to be a very fluctuating one owing to its taking only the surplus demand.

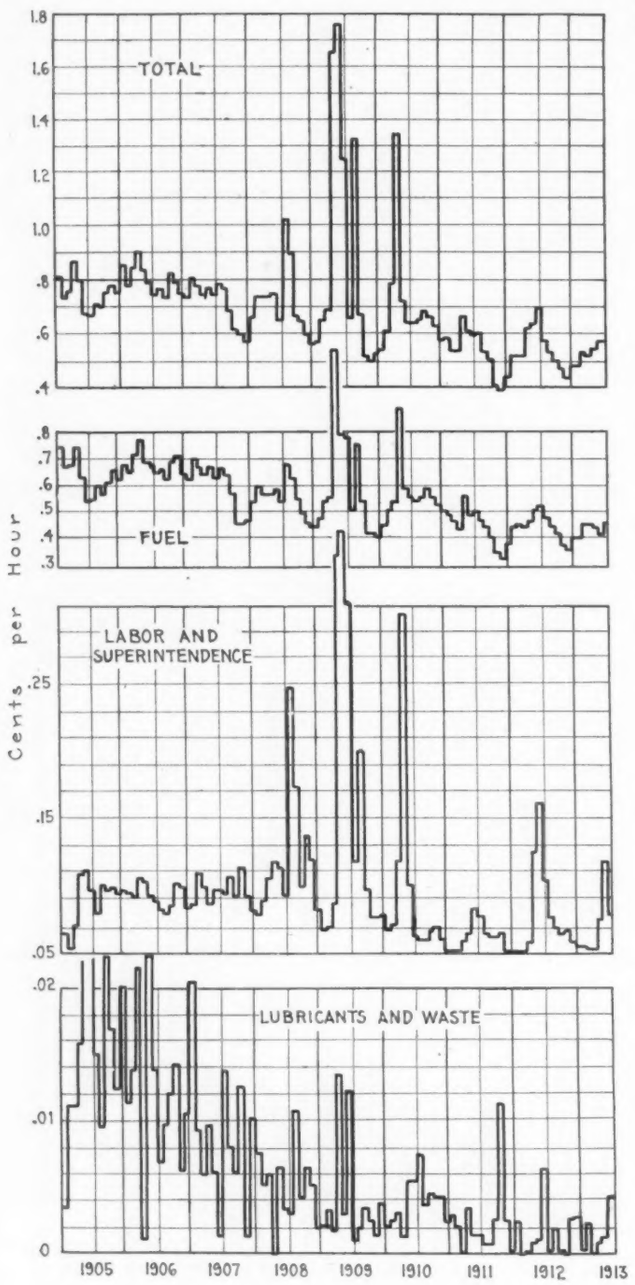


FIG. 8—TOTAL OPERATING COST PER KILOWATT-HOUR, WITH ANALYSIS

Fig. 8 contains an analysis of the cost of operating the steam plant, which is of special value on account of the fluctuating nature of this load. The average monthly cost varies between 1.76 cents per kw-hr. in May, 1909, when the load was but 966 kw, and 0.4 cent in November, 1911, when it was 12,500 kw. There has been a steady decline in the average cost, amounting in nine years to nearly one-half. This is largely due to the saving in fuel, due in turn to the use of more economical generating units. The reduction in labor cost is not great, as the gradual increase in wages partly offsets the saving due to the smaller number of men required per unit of output. The remarkable reduction in cost of lubrication is also brought out in this figure, since this outlay is practically nothing for the turbines. Fig. 7 is introduced to show how the output of the engines has become relatively less important until at present the remaining reciprocating unit is used practically not at all. There is a close relation between the engine hours and the cost of lubrication. In this graph the turbine hours are increased to engine-hour equivalents by multiplying the figures for the small turbines by 1.5 and those for the large ones by 3.

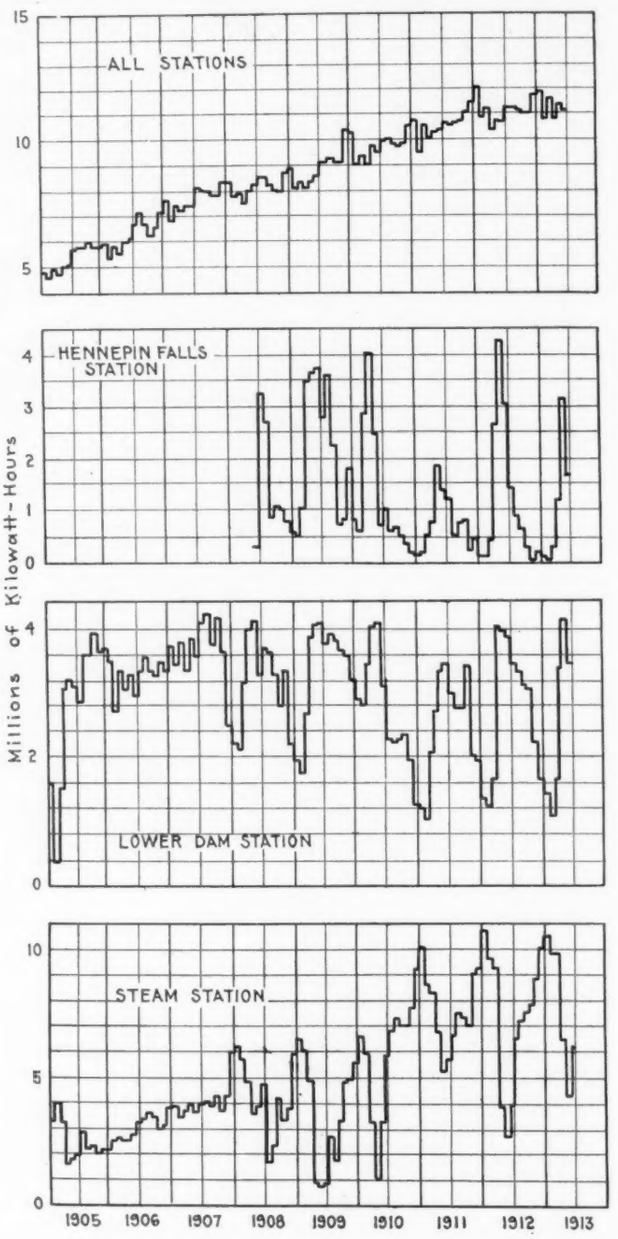


FIG. 9—CHART SHOWING OUTPUT OF STATIONS YEAR BY YEAR

Fig. 9 shows the gradual increase in the load and how this demand is met by the three parts of the plant. This increase, it will be noted, conforms to those in car miles and in energy consumption per car, which are plotted in Fig. 10. The same figure also indicates a close relation between the load and the passenger receipts, both of which have doubled in the period covered. A rough average shows that the income is 6.3 cents per kw-hr. produced. In spite of the constant effort to build lighter cars the kilowatt-hour consumption per car-mile is on the increase, although lately it has been more stable than formerly. The present value is 4.8 kw-hr. per motor-car-mile.

Another chart (Fig. 11) shows the great increase in thermal efficiency of the steam plant and its dependence on the load factor. The best result was secured in May of this year, when but 30,000 heat units were required per kilowatt. This gives a thermodynamic efficiency for the station of 11.4 per cent. Assuming a boiler efficiency of 70 per cent, the corresponding engine-turbine-room efficiency is 16.3 per cent. The best corresponding figures for the engine plant alone, in June, 1905, were 8.1 per cent and 11.6 per cent respectively. In comparing these percentages with others it must be remembered that they cover the entire monthly input and output. In view of the excellent character of the former engine plant the saving obtained is remarkable.

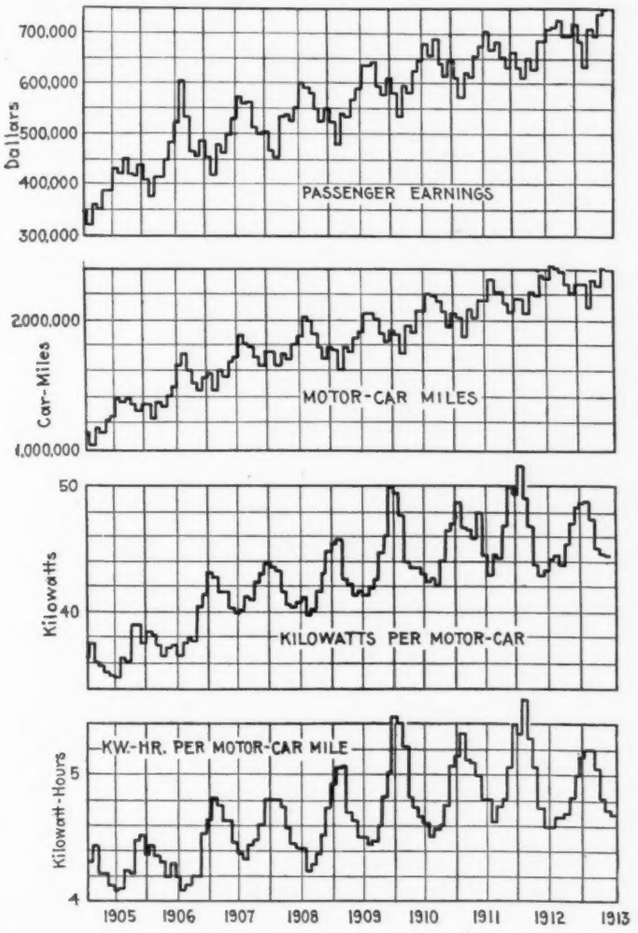


FIG. 10—GRAPHS OF SYSTEM OPERATING DATA

The sample records which have been reproduced in the illustrations accompanying this article are typical of a very large number regularly kept by the Minneapolis traction company. Most of them are plotted on loose-leaf notebook sheets, 5 in. by 8 in. in size, and suitable for blueprinting. The complete list of these graphical records comprises a very large number, and in addition there are numerous tables assembling the data. The important tables relate to the following items: Cost of power by months and years, total; operating cost of energy per kilowatt-hours (ranges between 0.678 cent and 0.52 cent); energy generated by months and years (shows increase in seven years from 64,296,424 kw-hr. to 133,227,996 kw-hr per year); operating energy per motor-car mile (varies from 4.29 kw to 4.99 kw); energy distributed in kilowatt-hours by months

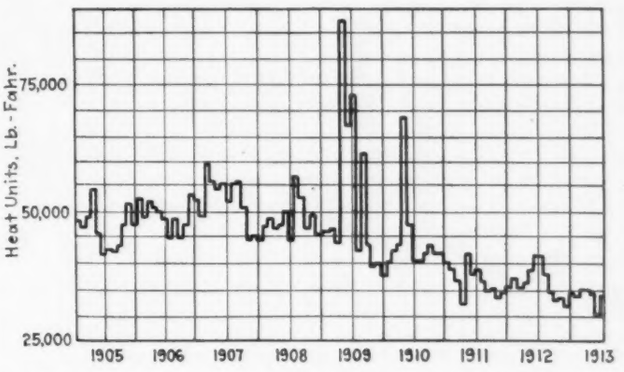


FIG. 11—HEAT UNITS CONSUMED PER KILOWATT-HOUR GENERATED

and years, and total and by divisions, last named also in per cent by divisions; energy consumption in kilowatt-hours per car-mile by divisions, by years and months, etc.

A monthly table is also made out for the estimated and actual energy secured from the water-power plants, the computed and actual costs of energy from the steam plants, etc. Other tables cover the average and maximum power developed by months, total, and for operation only; total motor-car miles made by years and months; total cost of power per motor-car mile, motor-car-hours, schedule speed (increased from 8.55 miles per hour in 1905 to 9.36 miles per hour in 1912); passenger earnings; cost of power

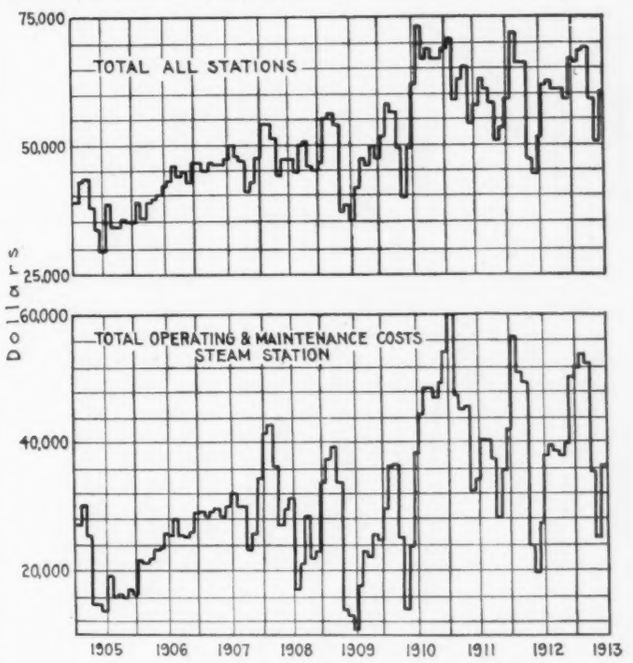


FIG. 12—CURVES SHOWING TOTAL COST OF POWER

in percentage of passenger earnings (varies up and down between 8.0 and 9.7); passenger earnings per motor-car-mile; passenger earnings per operating kilowatt-hour (has been gradually reduced from 7.32 to 6.09); kilowatts per motor car (has increased gradually from 36.7 to 45.7); power sold; cost of overhead maintenance; cost of track bonding, etc.

In the steam station the records are kept in great detail under the following headings: Kinds, amounts and qualities of coal received; cost of generating energy per kilowatt-hour, total and itemized under fuel, lubricants and waste, wages and superintendence, electrical maintenance, miscellaneous charges; average power generated; average fuel consumption per kilowatt-hour (3.39 lb. coal per kw-hr. is the general average); average heat value of fuel per pound and per kilowatt-hour (average value 34,680 heat units per kw-hr.); price of coal per 1,000,000 heat units (average value 12.58 cents); average kilowatts per boiler in service; total cost of operation and maintenance and itemized analysis of these; cost of handling coal per ton (runs from 8.8 cents to 7.2 cents); total cost of handling coal and cinders; price of coal per ton (averages about $2.577). Numerous other tables giving details of operation of boilers, engines, turbines, etc. The same system is carried out for line, substations and other parts of the system.

On account of the nature of these records and of the care which is taken in studying them the data given above will be useful for comparison with those of other plants. They show the results of consistent attention to essentials in the matter of power supply.

Some Observations on European Electrical Topics

By Dr. Louis Bell

Were I asked what had made the deepest impression upon me during a recent trip to Europe in things general as well as electrical, I should unhesitatingly answer that it was the continual evidence of world organization for the control of trade. I encountered it directly and indirectly, positively and inferentially, at every turn.

Could any one lay bare the interlocking interests, the remote controls, the friendly alliances, the "gentlemen's agreements," in which the great commercial powers are involved, it would, I think, prove the most startling chapter in the world's industrial history. The law of supply and demand has ceased to have more than a casual bearing on international trading, for that law does not presuppose the existence of world-wide combinations, formal and informal, organized for the express purpose of defeating that free competition upon which the law depends.

In the electrical business we all know something of the nature of the international situation and of its general results, but we have little conception of the extent to which every branch of activity carrying on operations of great magnitude is involved in organization in restraint of trade. Frankly, I do not believe that one case in ten is known to the general public, or is openly admitted—but just casually talk "export" to the American market and then watch for signs of abating enthusiasm. I am not thinking now of electrical work or other things in which patent rights are concerned, but of the general situation in many lines. Everyone with whom one talks on business topics has a fresh instance to add. The question has particular importance now in view of the new tariff legislation and its results and is a factor which I think has not generally been taken into account in considering the probable balance of imports.

A curious feature of the whole matter is the indirection by which some of the results are achieved, almost unconsciously at times. For example, I know of concerns that might do a very large and profitable American business were it not for their unholy alliances with American agents whose chief interests are not in importations. Many a good European reputation has suffered from such indifference. Perhaps the thing works both ways, however, for more than ever before I have seen the universal American invasion. From tooth powders and soap to machine tools and burglar-proof safes my countrymen are in the game. I could have duplicated my shoes in nearly every city I have seen, could have bought Waltham watches in Geneva or American hardware in Birmingham. In fact, I might almost go so far as to say that if one cannot find any well-known American product in Europe, the probable reason is to be looked for in confidential terms with foreign competitors or in agencies that stand still.

In electrical matters, to pass from these general topics, one finds again the governing factors in differences of practice not at all on the surface, but in interrelated things not in immediate view. For example, the facts which I have more than once referred to as regards interior wiring in Europe turn on the question of building construction. Where fireproof and slow-burning constructions are almost universal and our native fire-trap is quite unknown, wiring rules do not need to be drastic, and were they to make such rules the fire underwriters would not have that moral support from the public which gives them the absolute power they enjoy. The same cause, I think, underlies the extremely large use of high-pressure three-wire systems, with 200 volts to 240 volts on a side. Likewise the universal use of multiple connection for street lighting is at the bottom of the choice of illuminants and of their particular application. It quite explains the rarity of alternating-current arc lamps and also the evolution of certain types which are extensively used but would be impracticable under American conditions of service and of import duties. It is only in the little differences of detail that national fashions appear, uninfluenced by these larger considerations.

Electrical distribution is greatly facilitated by the European habit of concentrating population in compact villages, instead of the wide scattering that is usual with us. This fact shows up not only in the possibility of lowered prices but also, in certain regions, by the organization of high-voltage networks which would not be justified if one had to deal with users widely scattered over the country instead of in groups. In England, especially, the problem of lighting the large isolated country house is commonly solved not by running a long line overhead but by an isolated plant, either electric or gas. I have seen some exceedingly neat little gasoline engine and dynamo sets which are being advocated for such service with considerable success. On the other hand, the large isolated plant in urban territory seems to be less common than with us owing to smaller buildings and the lower prices due to moderate distribution costs. Even the competition with gas is on a different basis and introduces new problems, some of which were hinted at in the recent British Association discussion in these columns.

In England, at least, the differences in popular habits and in climate result in particular features of load curve, and service generally, quite distinct from those found in American practice. In fact, it is very difficult to treat English electrical statistics so as to make them properly comparable with our own. One has to go to the roots of things before finding what the comparison really means. In general, I think we are inclined to attach undue importance to mere difference in wages and not enough to difference in conditions in dealing with all manufacturing matters. In England difference in governmental affairs makes now and then for remarkable effects. The British government is, in spite of its nominal form, for good or ill now the nearest approach to popular rule yet tried by any great power, and the results are sometimes striking. For instance, the street lighting in London has been wonderfully improved of late, thanks to parliamentary powers which enable the local authorities to place cross suspensions wherever they see fit. The act once passed, there is no method by which litigious individuals can go behind the returns, and the cross suspensions are installed. At every point one meets long trains of apparently casual consequences which one is very apt to misinterpret in judging them by American standards.

Progress of Drum Development of Pacific Gas & Electric Company

By F. G. MUDGETT

The Pacific Gas & Electric Company is completing 25,000 kw of its 112,500-kw hydroelectric development on the South Yuba and Bear Rivers at Drum power station, above Alta, in Placer County, Cal. The project was actively begun in July, 1912, and the only interruption to the work was the heavy snows common to the winters at such altitudes as are found in the various divisions of the job. Now, after practically a year of steady work on construction, the big generators will be ready by Nov. 27 to deliver 100,000 volts over 110 miles of transmission line to Cordelia substation, the load center of the Pacific Gas & Electric Company, where further distribution at 60,000 volts to the coast and central California cities will be made.

WATER SUPPLY

The catchment area above Drum power house is 120 sq. miles in area, a watershed about at the summit of the Sierra Nevada Mountains, containing twenty-two smaller reservoirs all controlled to feed into the one large storage lake called Lake Spaulding. The capacity of Lake Spaulding, with the present 225-ft. dam, is 44,000 acre-ft., or about 14,400,000 gal. The ultimate dam will be 305 ft. from water surface and 320 ft. above bedrock, making it the highest dam in the world from water surface and comparable with the Arrow Rock dam, which is 260 ft. from water surface; the Roosevelt and Shoshone dams, both 240 ft. from water surface, and the Croton dam, but 160 ft. from water surface.

AQUEDUCTS

From storage the water is brought through a 4456-ft. tunnel in solid granite, 1100 ft. of which is concrete-lined, the finished size being 8 ft. 8 in. in diameter. An aqueduct 8.4 miles in length carries the water from the tunnel to Drum forebay, a large regulating reservoir having a capacity of 425 acre-ft., which insures continuous service at the power station by carrying the fluctuations between water supply and electrical load, as well as bridging any interruption in the canal system above.

PIPE LINE

The drop from the forebay to the nozzles of the impulse wheels is 1375 ft. A steel penstock or pressure pipe line (two lines eventually), 72 in. in diameter by ¼ in. thick at the forebay and tapering according to pressure to 52 in. in diameter by 1¼ in. thick at the power house, is the connecting link.

FIG. 1—DRUM POWER STATION IN BEAR VALLEY GORGE

POWER HOUSE

The Drum power station is located in the Bear River gorge about 5 miles above Alta. To find a site for the power house it was necessary to sluice by means of the hydraulic monitor some 40,000 cu. yd. of hill slope, excavating finally by blasting into solid serpentine. The site is about 125 ft. by 500 ft. in size.

The erection of the building was begun in October, 1912, and the structural steel frame was completed in January, 1913, the work being terminated under unfavorable conditions in the winter. The building was designed under the direction of the civil engineer of the company for four 12,500-kw units, two of which are now installed. It is a reinforced-concrete and structural-steel structure, 77 ft. 6 in. wide by 208 ft. 8 in. long and 65 ft. high, and was completed in October, 1913.

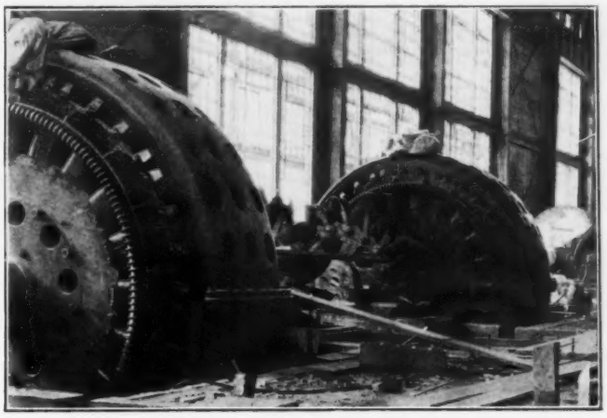


FIG. 2—TWO 12,500-KVA HYDROELECTRIC UNITS IN DRUM POWER PLANT

EQUIPMENT

The two 12,500-kva Westinghouse generators now in place are 6600-volt, three-phase, 60-cycle, twenty-pole machines. They are of the revolving-field type, horizontally divided. The armature is Y-connected. The generators are liberally rated and will carry their full load continuously with a moderate temperature rise, even under unfavorable climate conditions and low power-factors. The speed of the machines is 360 r.p.m.

The shafts of the armatures are horizontal, built with enlarged ends upset 2 in. for the reception of the overhung waterwheel runners, which are pressed on. At each end of the shaft a Pelton-Doble impulse wheel of 9000 maximum hp is overhung beyond the bearings. The shafts and bearings were made by the Westinghouse company. The maximum diameter of the shaft through the rotor is 26¼ in., and 18 in. at the bearings, which are 60 in. each in length. The over-all length of the shaft is 24 ft. 8¼ in. and its weight 26,420 lb. The diameter of the pitch circle of the waterwheel, which has seventeen double buckets attached thereto, is 85 in. The heaviest part weighs 10,000 lb. net, and all parts weigh approximately 75,000 lb. Each wheel is driven by a single deflecting jet. Its size is controlled with a needle valve, and the jet at maximum rating is 6⅞ in. in diameter.

GOVERNORS

Governing is effected by a special oil-pressure-operated, relay-valve-type horizontal Lombard governor, which operates the deflecting nozzle directly. The body of the nozzle is 8½ in. inside diameter at the jet, opening and increasing to 26 in. at the ball joint. It is counterbalanced with a hydraulic piston.

The speed drop for gradual increase from no load to full load is adjustable from 0 per cent to 2 per cent. An electrical distance speed-control device operated from the switchboard by 125-volt direct current is provided. This enables the operator to vary the speed from 5 per cent above to 15 per cent below normal speed. A hand emergency control is mounted so as to revolve freely on a threaded piston rod, which can be connected with or disconnected from the piston rod by means of a split bronze

nut locked by suitable lever mechanism. An operator on the regular hand wheel can easily exert the full output of the governor, which is 20,000 ft.-lb. per stroke in three-quarters second with full port opening. This can be regulated to increase the time of action to any desired extent.

Exciters and Transformers

The exciters to be used with the generating units are of 400-kw, 125-volt, 514-r.p.m. rating and are directly connected to single overhung 600-hp Pelton-Doble impulse waterwheels. Each unit is also equipped with a 600-hp, 2200-volt Westinghouse induction motor, which will serve to drive the exciter in the event of any accident to the waterwheel.

From the generators the energy is led through the low-tension switches to six 4250-kva, single-phase transformers, with an additional spare unit for energencies. When 6600 volts are impressed on the low-tension winding, which has several taps, line voltages from 110,000 volts to 125,000 volts will be obtained. All transformers will operate in parallel under any non-inductive or inductive load within their ratings. The line control at Drum power station is handled from the 125,000-volt switching gallery, which is equipped with oil and disconnecting switches.

All station switching is controlled from a switchboard of the benchboard type designed in such manner that the entire station with the four hydroelectric units and all auxiliaries may be completely controlled both hydraulically and electrically from it.

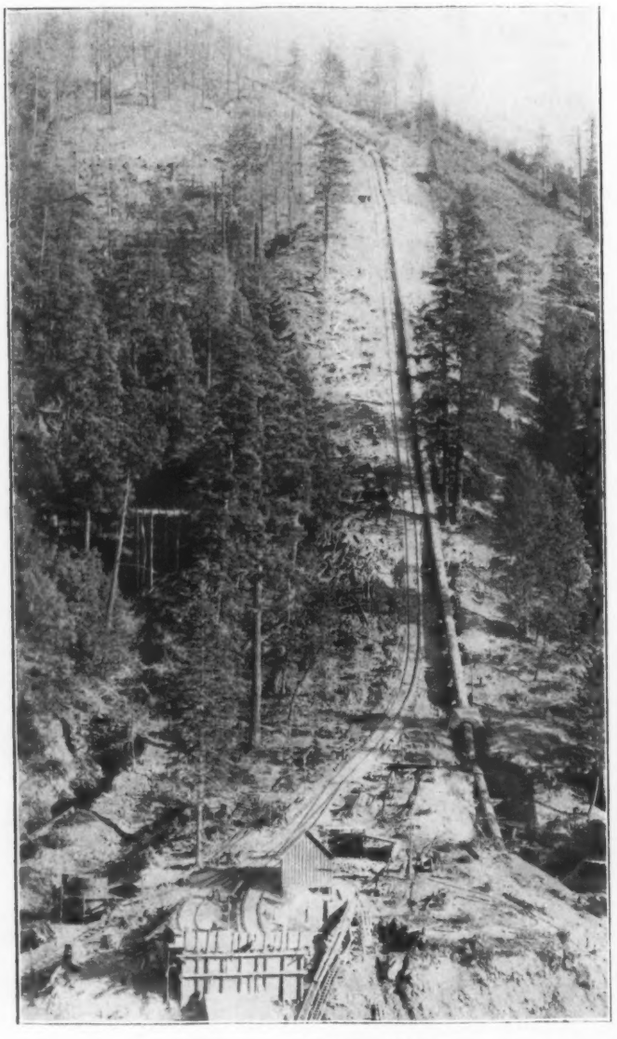


FIG. 3—DRUM PENSTOCK

FIG. 4—STEEL TOWER ON DRUM-CORDELIA TRANSMISSION LINE

Transmission

The transmission line extends 110 miles westerly to Cordelia substation. The line towers are constructed to carry a double circuit, half of which is now completed. On account of the elevation at Drum power house the snowfall is as great as 25 ft. in a season, requiring the use of a special single-circuit steel "snow tower" over the first 13 miles. A double-circuit steel tower is employed on the remaining 97 miles and carries the wires in a vertical plane, the wires on the snow towers being carried in a horizontal plane. The towers are spaced about 800 ft. apart in the lowlands and as far apart as 2350 ft. in the mountains.

The use of both copper and aluminum conductors is exemplified in this line. The copper wire is No. 000 seven-strand (about 0.5 in. in diameter) and is used in the possible snow districts where sleet loads might be expected, as well as in the upper bay districts where sea fogs reach the line. The aluminum wire is No. 00000 nineteen-strand (about 0.625 in. in diameter) and spans 58 miles of the Sacramento Valley where snows and sea fogs are practically unknown.

The hydroelectric project is under the direction of Mr. F. G. Baum, chief engineer of the Pacific Gas & Electric Company. Assisting him are Mr. P. M. Downing, assistant chief engineer; Mr. J. P. Jollyman, electrical engineer; Mr. H. C. Vensano, civil engineer, and Mr. P. E. Magerstadt, resident engineer. Mr. F. G. Drum is president of the company, Mr. John A. Britton is vice-president and general manager, and Mr. A. F. Hockenbeamer is second vice-president and comptroller.

Combined Synchronous and Induction Motor Loads

Discussion of the advantages of utilizing synchronous motors and converters for improving the power-factor in alternating-current systems. By H. L. Wallau

THE power-factor of induction motors is a subject that of late years has forced itself vigorously upon the attention of central-station engineers and managers, owing to the rapid strides made in the application of electricity to all classes of industrial activity. Many valuable papers have been written on the use of synchronous motors and condensers for the correction of "lagging" power-factors and the economics of the value of condensers have been touched upon.

It is not the author's intention to dwell at length on the causes of or the corrective measures required to overcome low power-factor, but merely to review certain basic principles and present some data gathered under actual operating conditions.

TABLE I—TESTS BEFORE INSTALLING SYNCHRONOUS CONDENSERS

Designation of Feeder	Apparent Load, Kva.	True Load, Kw.	"Wattless" Load, Kva.	Power-Factor in per Cent	Remarks
A.....	375	270	259	72	Single foundry, blowers, tumblers, grinders and machine tools.
B.....	566	430	368	76	Single factory, automatic screw machine and machine tools, group drive.
C.....	533	320	426	60	General motor service in small shops.
D.....	250	140	210	56	General motor service in small shops.
E.....	135	80	108	59	Machine tools and electric welders.
F.....	175	100	143	57	Drop hammers, grinders, etc.
Station...	2,300	1,400	1,820	61	.....

General Considerations

Induction motors and other inductive apparatus draw from the line a current which is not in time-phase with the supply voltage. The current so drawn can be analyzed into two components, one in time-phase with the supply voltage and representing useful work, and the other in time-quadrature to it, representing "reactive" power. The wattless component of the current supplied reacts directly on the generator fields, demagnetizing them and increasing the excitation required to maintain the voltage. Moreover, the inductive effects of the lagging current in lines and transformers are far more serious than those produced by non-inductive loads. Motors, lines, transformers, generators, all have increased losses due to the excess current required with low power-factor, losses being increased by 23 per cent for 90 per cent power-factor, 56 per cent for 80 per cent power-factor, 104 per cent for 70 per cent power-factor, 178 per cent for 60 per cent power-factor and 300 per cent for 50 per cent power-factor.

The power-factor of the average induction motor operated on a circuit of rated voltage and frequency varies from 50 to 90 per cent, depending upon the size of the motor and the load carried. High power-factor can be maintained on induction motors only when carrying their full loads. Complex industrial conditions prevent this condition from being realized, and on the lines of supply systems are large numbers of lightly loaded induction motors operating at greatly reduced power-factors.

Effect of Over-Voltage

While it is true that an induction motor will operate satisfactorily at from 10 to 15 per cent increase in normal voltage, gaining slightly in efficiency, pull-out and starting torque, it is nevertheless at a sacrifice in power-factor, which reacts to the disadvantage of the supply system. Central-station managers should, therefore, insist that consumers install motors designed to operate normally at, or very nearly at, the supply company's standard voltage. For example, a 220-volt motor and not a 200-volt motor should be installed by customers using energy from a 220-volt to 230-volt supply circuit.

The combination of under-load and over-voltage may lower the power-factor of motors under average operating conditions until the resultant line power-factor is from 50 to 60 per cent, with from 175 to 300 per cent increase in losses and from 60 to 100 per cent increase in total investment. The revenue derived is generally based on the hours' use of the demand in kilowatts, which rate takes no account of the increased investment accompanying low power-factor or of the greater losses caused thereby.

Power-Factor of Commercial Circuits

Some years ago the effects of the low power-factor on the day load of a certain central station reached a critical point. It was impossible to maintain pressure without heavily over-exciting the generator fields, and to keep the engines from hunting the generators had to be kept well loaded with true power, resulting in enormous overloads in current and dangerous rises in temperature in all the windings.

Tests were made at one of the substations to determine what the actual line conditions were. The results of these

TABLE II—TESTS AFTER INSTALLING SYNCHRONOUS CONDENSERS

Load on Distributing Lines				Load on Condensers				Load on Step-Down Transformers				Voltage of Distributing Bus.	Remarks
Apparent Load, Kva.	True Load, Kw	"Wattless" Load, Kva.	Power-Factor per Cent	Apparent Load, Kva.	True Load, Kw.	"Wattless" Load, Kva.	Power-Factor, per Cent	Apparent Load, Kva.	True Load, Kw.	"Wattless" Load, Kva.	Power-Factor, per Cent		
2,370	1,700	1,635	72	1,440	100	1,435	6.9	1,820	1,800	200	99	2,300	Mixed lighting and motor load.
2,310	1,700	1,565	73.5	700	50	697	7.1	1,950	1,750	868	90	2,280	Mixed lighting and motor load.
3,350	2,500	2,920	65	1,315	100	1,310	7.5	3,060	2,600	1,610	85	2,240	Motor load only.

tests led to the installation of small synchronous condensers and motors on some of the consumers' premises and of large condensers at some of the substations.

The first series of tests gave the results indicated in Table I. The line power-factors varied from 56 to 76 per cent, and the average day load power-factor of the substation was 61 per cent.

TABLE III—TESTS ON GENERAL MOTOR-SERVICE CIRCUITS

Designation of Feeder	Apparent Load, Kva.	True Load, Kw.	"Wattless" Load, Kva.	Power-Factor, per Cent	Remarks
A	217	160	145	74	Single foundry.
B	842	740	400	88	200-kva condenser effect, single factory.
C	675	500	453	74	80-kva condenser effect, general motor service.
D	265	180	193	68	General motor service, small shops.
E	695	480	502	69	Two factories employing welding extensively.
F	157	130	88	83	Mixed lighting and motor service.
G	456	360	276	79	80-kva condenser effect, single shop.
H	407	350	203	86	Large foundry, blowers and machine tools.
I	446	330	307	74	General motor service.
J	112	64	92	57	General motor service.
K	227	147	172	65	General motor service.
L	311	251	182	81	200-kva condenser effect.
M	349	275	213	79	Large paint-manufacturing company.
N	100	88	48	88	Clothing factory.
O	187	111	151	59	Two factories; motors carry about one-third load.
P	191	157	109	82	Lumber yards; motors carry about two-thirds load.
Q	717	554	448	78	80-kva condenser effect.
R	300	222	200	67	Large automobile factory, motor load.
S	575	425	380	67	Large automobile factory, motor load.
T	443	191	400	90	Large automobile factory and general motor service, 200-kva condenser.
U	450	237	380	85	80-kva condenser effect.
V	93	42	80	86	Lighting and motor service.
W	780	577	520	67	Large paint-manufacturing company and general, motor load.

After the installation of two 750-kva synchronous condensers at this substation the test results in Table II were six feeders, designated by the letters A, B, C, etc., are identical with the feeders similarly lettered in Table I, the effect of the application of the local condenser on B and C and of increased loading of the motors on E being quite apparent.

Data were also collected on about sixty different installations, comprising a variety of industries, some large and some small consumers. The power-factors of the installations are given in Tables IV and VI. It must be noted that the great majority of these tests represent average maximum-load conditions, and so the power-factors given are apt to be high rather than low. The highest power-factor noted is 95 per cent, the lowest 20 per cent. These values are averages over a period of three minutes. The general average of all average figures is about 69 per cent. Table V gives some data on the transmission lines and generating station for day and night load.

TABLE V—TESTS OF RECEIVING CIRCUITS

Receiving Circuit	Day Load		Night Load	
	Load	Power-Factor	Load	Power-Factor
Transmission line	1,400	64	3,425	89
Transmission line	2,200	97.5	2,050	99
Transmission line	3,920	81	2,150	77
Transmission line	1,770	87	2,150	83
Motor-generators	960	97	1,180	94
Miscellaneous	700	....	145	..
Station load	10,950	89	11,100	92

NOTE.—High power-factors on transmission lines are due to condensers or motor-generator sets becoming over-excited.

The approximate comparison given in Table VII may be obtained. These results bring out strongly the advantages to be derived from the use of power-factor corrective apparatus.

More recently another series of tests was made on the motor-service circuits, as shown in Table III. The first of interest. Neglecting land and buildings, the investment per kilowatt of demand at the consumer's premises will be divided as shown in Table VII. Column A gives the investment for unity power-factor load, Column B the investment for 60 per cent power-factor load, Column C for 60

TABLE IV—TESTS OF GENERAL MOTOR-SERVICE CIRCUITS

Character of Installation	Remarks	Kilowatt Demand			Power-Factor		
		Maximum	Minimum	Average	Maximum	Minimum	Average
Machine shop	Builders of machine tools	23	11	17	92	72	79
Machine shop	Builders of machine tools	33	14	21	56	35	50
Machine shop	Manufacturer of foundry supplies	28	24	26	75	75	75
Machine shop	Builders of machine tools	46	38	42	82	72	75
Machine shop	Builders of machine tools	27	16	22	74	58	69
Machine shop	Railroad repair shop	72	50	60	66	63	65
Machine shop	Tool manufacturers	40	34	38	65	63	64
Machine shop	Buffers and machine tools	45	38	42	82	68	72
Machine shop	Screw manufacturers	100	90	95	79	74	75
Machine shop	Safe manufacturers	55	44	40	87	87	87
Machine shop	Manufacturer of gas machinery	13	4.5	6	50	20	35
Machine shop	Manufacturer of children's toy wagons	35	26	31	71	60	63
Machine shop	Manufacturer of cap screws	75	67	70	54	52	53
Foundry	Blowers, tumblers, drill presses	269	104	152	76	71	72
Foundry	Blowers, tumblers, machine tools	23	18	20	77	69	71
Foundry	Blowers, tumblers, machine tools	66	37	57	82	77	80
Foundry	Blowers, tumblers, machine tools	19	17	18	72	68	70
Foundry	Blowers, tumblers, machine tools	193	132	150	91	89	90
Foundry	Blowers, tumblers, machine tools	73	66	70	68	65	67
Foundry	Blowers, synchronous motor-generator set	103	65	82	92	88	90
Foundry	Blowers and tumblers, etc	31	25	27	92	90	91
Foundry	Blowers and tumblers, etc	108	42	52	75	59	61
Automobile factory		139	106	125	75	64	65
Automobile factory	Same when slack	..	..	..	..	..	52
Automobile Factory		..	..	360	..	..	60
Automobile Factory		22	10	13	72	63	70
Forge shops	Drop hammers	6	5	5.6	50	41	43
Forge shops	Blowers only	18	12	13	94	90	92
Forge shops	Same shop, light load	4	2	3	60	35	50
Forge shops	Large shop	..	..	400	..	..	90
Forge shops	Hammers, light	24	12	16	85	35	75

per cent power-factor load from consumer to substation and 85 per cent power-factor from substation to generating station, Column D for 85 per cent power-factor load at the consumer's premises, condensers being installed ahead of the consumer's meters.

The relative cost of small condensers has been taken at 12 and of large condensers at 4 per kilovolt-ampere in terms of the total under Column A. It will be noted that there is only a slight decrease in investment where condensers are placed at the consumer's premises instead of at the substation, owing to the much higher cost of the smaller condensers. The difference in losses is, however, much more marked. Table VIII gives the relative energy losses per kilowatt of demand under the four conditions applying to Table VII.

In Table VIII the field losses have been computed on the basis of the ampere-turns of the generator armatures, being equal to 20 per cent of the ampere-turns of the generator field circuit.

Under the above conditions the kilowatt demand on the generating station per kilowatt of consumer's demand would be relatively as follows for the four cases enumerated: A = 100; B = 145; C = 138; D = 112, while the kilovolt-ampere demands would be A = 100; B = 242; C = 162; D = 132.

Assuming a load-factor corresponding to 250 hours' use per month, the relative cost of energy in the above four cases (taking into account fixed charges on the equipment required and the running costs on the energy generated) will vary approximately as follows per kilowatt-hour: A = 100; B = 155; C = 133; D = 119.

It is apparent from the above data that it will pay central-station managers to study the loading of the induction motors on their circuits with a view to maintaining them at the highest possible average load.

In large installations one or more synchronous motors should be installed, if possible, where part of the load can to advantage be carried on a motor-generator set, as for example where adjustable-speed direct-current motors are required or where the motor can be allowed to accelerate without load. Local synchronous condensers should be used in the larger installations where no suitable load for synchronous motors is available.

Large synchronous condensers should be installed in exclusively alternating-current substations, and synchronous motor-generator sets in substations carrying a mixed alternating-current and direct-current load, to correct for the low power-factor on those feeders to which local correction cannot be applied.

Rate systems should provide the lowest kilowatt-hour charge to the load of unity power-factor.

TABLE VI—TESTS OF MISCELLANEOUS INDUSTRIAL INSTALLATIONS

Character of Installation	Remarks	Kilowatt Demand			Power-Factor		
		Maximum	Minimum	Average	Maximum	Minimum	Average
Refrigeration	Fish company	20	16	17	75	70	73
Refrigeration	Same company under light load	15	2	10	65	20	50
Refrigeration	Skating rink	189	66	..	77	73	75
Air compressors	Average load light	..	..	25	..	..	50
Brick yard	Mixers and presses	32	21	27	79	64	75
Metal working	Presses and machine tools	170	89	121	95	95	95
Stove works	Machine tools	18	15	17	69	63	65
Structural iron	Punches and shears	29	4	12	82	37	60
Salt extractors	Pumps	158	54	73	59	52	55
Woodworking	Sash and door work	14	2	8	73	64	69
Woodworking	Lumber yard	50	22	33	91	75	88
Woodworking	Counters and bar fixtures	29	15	20	87	82	84
Woodworking	Moldings	108	59	80	68	63	65
Textile industries	Garment makers	94	77	88	85	85	85
Textile industries	Knitting mill	13	11	12	50	45	47
Textile industries	Garment makers	16	10	12	67	62	65
Elevators	Grain elevators	..	..	11	..	..	87
Elevators	Freight elevator	5	1	3	75	59	66
Paint manufacturers	Grinders and mixers	3	1	2	80	47	75
Paint manufacturers	Grinders and mixers	24	6	18	88	68	85
Paint manufacturers	Grinders and mixers	16	10	14	65	61	62
Paint manufacturers	Grinders and mixers	..	..	275	..	..	79
Food products	Meat curing	32	10	15	80	75	77
Food products	Abattoir	..	..	18	..	..	69
Food products	Noodle factory	29	27	28	90	88	89
Plaster factory	Grinders and mixers	41	17	29	87	75	82
	Manufacturer phonograph records	7.5	4.5	6.3	78	72	72
Electric welders		..	..	..	65	30	50

TABLE VII—INVESTMENT WITHOUT AND WITH POWER-FACTOR CORRECTION

	Relative Investment per Kilowatt Delivered			
	A	B	C	D
Consumers' meters	1.60	2.67	2.67	2.67
Consumers' transformers	5.00	8.35	8.35	5.88
Distributing lines and switchboards	10.00	16.70	16.70	11.78
Step-down transformers	2.40	4.00	2.82	2.82
Transmission lines	11.00	18.35	12.92	12.92
Generating equipment	70.00	116.80	82.40	82.40
Condenser capacity	.....	.....	2.86	8.60
Total relative investment per kw	100.00	166.87	128.72	127.07

TABLE VIII—LOSSES WITHOUT AND WITH POWER-FACTOR CORRECTION

	Relative Losses per Kilowatt Delivered			
	A	B	C	D
Consumers' transformers	15.0	41.7	41.7	20.8
Distributing lines	60.0	167.0	167.0	83.2
Step-down transformers	4.0	11.1	5.5	5.5
Transmission lines	18.0	50.0	24.9	24.9
Field excitation	3.0	3.6	3.3	3.3
Added for condensers	.....	.....	1.8	8.0
Total relative losses per kw	100.0	273.4	244.2	145.7

Central Station Management

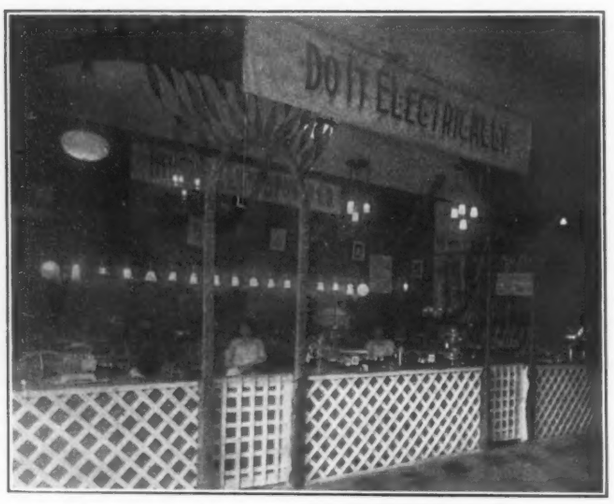
Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Electric Regulations in Minneapolis

The Minneapolis General Electric Company has issued a booklet entitled "Regulations for Electric Service." The pamphlet is intended particularly for the use of contractors, architects, engineers and others who have to do with installations on the company's central-station service. Four classes of direct-current and alternating-current service available are listed, and contractors are requested, before beginning construction work or before making any changes in existing installations, to confer with the engineering department of the company. Plans and specifications for 2300-volt installations should in all cases be submitted to the engineering department for approval. The booklet contains in compact form much useful information about inspection, wiring, meters, standard meter boards, wiring for meters, motors and other apparatus that may be connected to the system, as electric signs, rectifiers, heating apparatus and the like. In addition there are given tables and useful information of general application. Altogether the pamphlet is valuable for reference. Messrs. H. M. Byllesby & Company, of Chicago, Ill., are the engineers and managers of the company.

A Prize-Winning Central-Station Display

First premium was awarded to the display booth of the Titusville (Pa.) Light & Power Company at the recent Oil Creek Agricultural Fair, which is reproduced in the accompanying illustration. Various household and heating devices were exhibited, including electric machines, toasters, percolators, stoves, fans, cooking ranges, washing machines, vacuum cleaners, forge blowers, sewing-machines, etc. All of these devices were in actual operation. Striking use was made of tungsten lighting units of various sizes, and above the booth there hung the familiar slogan in large letters, "Do It Electrically." Mr. Eugene F. McCabe is vice-president and manager of the company.



CENTRAL-STATION BOOTH AT TITUSVILLE (PA.) FAIR

More Electric Vehicles for Louisville Company

The Louisville (Ky.) Gas & Electric Company, which has been employing a large fleet of electric vehicles for meter-reading, repair work and other purposes, has just added to its equipment two Urban trucks built by the Kentucky Wagon Manufacturing Company, of Louisville. These new electric cars will be used for the general work of the service department.

The electric company reports that from past experience its electric trucks have been found not only economical and satisfactory from an operating standpoint, but also an excellent advertisement for the electric vehicle and central-station service.

Flash-Lamp Attachment on Portable Test Case

Portable meter-testing outfits used by the Brooklyn Edison company are being equipped with flash-lamp attachments to be used for lighting dark corners, attics, basements, etc., when searching for meters. A lens is fixed in one end of the test case like that in a box camera, and behind it is a miniature incandescent lamp which can be lighted by a small battery fastened under the lid. By pressing a button near the handle of the case and pointing the lens in the direction desired, light can be thrown on the object sought. With this attachment on the test set, the man carrying it does not need to carry a pocket flash-lamp, which is generally in an out-of-the-way pocket when wanted.

Electrical Irrigation in California

Irrigation by motor drive already has an excellent start in its development in California, according to Mr. Samuel Kahn, vice-president and general manager of the Western States Gas & Electric Company, of Richmond, Cal. Every farmer who has electric service on his ranch acts as a new-business solicitor for the company, and now even the real-estate companies engaged in subdividing tracts of land for sale are offering a motor and a pump with each five-acre and ten-acre purchase. At the same time the real-estate man has the purchaser sign an application for motor service which is forwarded to the electric company.

Mr. Kahn adds that for irrigation work in his district three-phase, 60-cycle, 220-volt squirrel-cage motors have been found most satisfactory. Open-runner centrifugal pumps seem to be the most popular type of pump. Surface flooding is generally used, but sub-irrigation is rarely employed in the districts supplied with energy by this company. The water is generally pumped from wells, as a generous supply usually exists at depths varying from 30 ft. to 50 ft. The principal agricultural products of the Western States' territory are grapes, almonds, olives, apricots, peaches and cherries. Alfalfa is raised extensively, while garden truck and some strawberries are grown.

The cost of farm labor varies from $1.50 to $2.50 a day. Electric-service rates for motors are as follows: First 1000 kw-hr. use per month, 3 cents per kw-hr.; second 1000 kw-hr., 2.5 cents; all excess over 2000 kw-hr., 2 cents. Energy for motors of 50 hp or larger is furnished at 1.5 cents per kw-hr. per month, the minimum charge per hp

per year being $6. The lighting rate in irrigation districts is 8 cents per kw-hr.

The first effort of the Western States Gas & Electric Company to obtain this kind of business was made in February, 1912. Since that time and up to Oct. 2, 1913, a total load of 4652 hp has been connected. A transmission line 150 miles long in the vicinity of Stockton and Lodi, Cal., furnishes energy for most of these irrigation projects. The Western States Gas & Electric Company is a Byllesby property.

Small-Town Service in Colorado

Some rather interesting figures covering service in a community of less than 5000 population were given in a paper on "The Central Station in the Small Town" read at the recent convention of the Colorado Electric Light, Power & Railway Association. The author, Mr. H. L. Titus, said that in this place with only 451 residence connections his company had placed about 390 electric flatirons, 192 toaster stoves, 100 toasters and 42 heating plates, in addition to a number of electric cookers, washing machines and vacuum cleaners. These are all operated in residences at the regular lighting rate. In addition the company has placed fourteen private pumping plants of sufficient rating to care for the sprinkling of lawns, etc. From these the company receives from $1.50 to $4.50 a month on an 8-cent rate. A recent attempt was made to introduce the electric cooking range and the hot plate, and twenty-four units of this character are now in service. The rates for this class of service are 4 cents per kw-hr. for electric ranges with a minimum of $1.50 a month and 5 cents for hot plates with a minimum of $1 a month. With these rates the operating cost does not become excessive, ranging from $2 a month for the hot plates to perhaps $7.50 a month for the larger ranges.

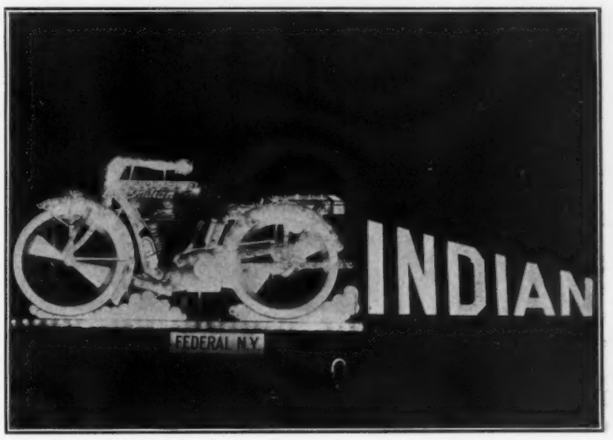
A close basis for estimating the cost of electric cooking when talking with a prospective range customer is to allow 1 kw-hr. per day for each adult person in the household and about one-half of this where the hot plates are used.

Worcester Factory Group Adopts Central-Station Service

The Worcester (Mass.) Electric Light Company has closed a contract for the supply of electric motor service to the Merrifield Building Trust, which owns one of the most notable factory groups in central New England. Forty-two three-phase, 440-volt motors will be installed, ranging in size from 0.5 hp to 75 hp and aggregating 418 hp connected load. The tenants are mainly engaged in woodworking, machine-shop practice, electroplating, laundry work and manufacturing on a small scale. Energy was formerly supplied to these buildings by line shafts driven through belts and gearing by a 450-hp single-cylinder condensing steam engine and four motors of from 35-hp to 75-hp rating were operated from a 150-kw belt-driven generator. The engineers' survey disclosed excessive friction losses in transmission between various floors and buildings, and a 35-hp motor was found to be carrying a load of but 5 hp under average conditions. Under the new conditions of central-station service, the main line shafting will be practically eliminated, all gearing will be discarded and the loading of individual motors will be closely proportioned to their rating. Separate meters will be installed for each tenant and the only fuses between the center of distribution and each tenant's motors will be located on each tenant's premises, a plan adopted to cut down interference and delays in operation. Nine hoists and elevators will be electrically equipped. The smaller motors will probably be wired for starting direct from the line without fuses, a double-throw, triple-pole spring switch being used for the purpose. A spring throws the switch out of the starting position if the handle is released.

A Large Motor-Cycle Sign on Central-Station Service

A recent addition to the electric-sign installations on the system of the Boston Edison company is illustrated herewith, the sign being located on Massachusetts Avenue, Boston, on the roof of a building occupied in part by the agency for a well-known maker of motorcycles. The sign is 24 ft. over all and contains 376 2-cp lamps wired in multiple on a 110-volt direct-current circuit. The display represents a motorcycle in operation at full speed, the rider being made purposely inconspicuous. The flashing equipment provided produces a striking effect of revolving wheels



MOTOR-CYCLE SIGN ON CENTRAL-STATION SERVICE

and flying clouds of dust thrown out at the rear and carried away through the trade name of the manufacturer's product. The letters are reduced in size as they leave the wheel, and this heightens the effect of apparent high speed secured from the flasher. The motorcycle wheels are 4 ft. 6 in. in diameter and the sign is 12 ft. high. Its first cost was about $600, and the cost of operation on the Edison system is about $30 per month maximum, from dusk to midnight. The sign was built by the Federal Sign Company of New York according to the designs of Mr. G. H. S. Young, of the Boston Edison company.

Motor Drive Reduced Oil-Pumping Costs 37 per Cent.

The United Oil Company has realized a reduction of 37.5 per cent in the cost of operating its property in the Midway oil fields, near San Joaquin, Cal., by substituting electricity for steam, this percentage of increase being based on a comparison of the actual outlay for the last two months of steam operation with that for the first two months of electric drive. Eight pumping motors have been installed on as many producing wells.

The accompanying table gives a detailed account of the expenses for September and October, 1912, the last two months of steam, and for January and February, 1913, the first two months of sole electric operation, showing a saving of $990.02, which is equivalent to the cost of 3300 barrels of oil at an average price of 30 cents a barrel. A study of these figures shows that a saving of 86.2 per cent has been made for water, 46.2 per cent for oils and grease, 13.5 per cent for fuel oil, and 8.6 per cent for labor. The need of boiler compound was eliminated entirely. Deterioration was not considered, although, on account of the heavy maintenance expenses.

of boiler plants and steam lines, the comparison would prove electricity cheaper in this respect also.

Many other oil companies in California are awakening to the fact that electricity is more economical than steam.

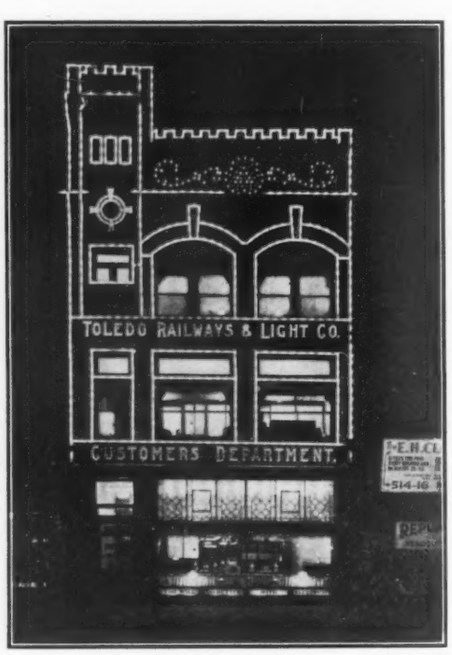
COST COMPARISON OF OIL-WELL PUMPING BY STEAM AND ELECTRIC DRIVE

STEAM EQUIPMENT			ELECTRICAL EQUIPMENT		
	Sept., 1912	Oct., 1912		Jan., 1913	Feb., 1913
Water	$449.99	$457.83	Water	$71.00	$53.90
Fuel	469.00	305.50	Fuel	340.00	329.90
Labor	448.00	448.00	Labor	435.00	383.50
Boiler compound, oil and grease	30.00	30.00	Oil and grease	17.50	17.50
Total	$1396.99	$1241.33	Total	$863.50	$784.80
Total two months		$2638.32	Total two months		$1648.30
Average per month		$1319.16	Average per month		$824.15

In the Midway fields alone there are now about thirty companies using a total of more than 300 pumping and drilling motors.

Toledo's Customers' Department

An attractive "customers' department" has been established by the Toledo Railways & Light Company, of Toledo, Ohio, in a building adjoining its old headquarters. Hundreds of tungsten lamps are used to outline the structure, whose castellated cornice and tower make it prominent among all the other buildings on this much-traveled street. The ground floor is given over to a display room where



THE "CUSTOMERS' DEPARTMENT" OF THE TOLEDO COMPANY

electric cooking and heating appliances, lamps, domestic devices, etc., are on exhibition. A rest room for the convenience of women customers is also one of the evidences of the utility company's thoughtfulness toward its local public. The Toledo motto, "You will do better with electricity," has a prominent position on an electrically lighted transparent sign bordering the display window.

Electricity on James J. Hill's Farm

The new hundred-and-fifty-thousand-dollar mansion which Mr. James J. Hill is having constructed on his 7000-acre farm at North Oaks, near White Bear, Minn., will be equipped to utilize electricity to the fullest extent. Electric motors will be used for various farming operations, the total connected load amounting to about 65 hp. Energy will be supplied to the North Oaks estate by the Stillwater division of the Consumers' Power Company, a Byllesby property.

Prior to signing a five-year contract with the Consumers' Power Company, Mr. Hill had experts investigate the advisability of an isolated power plant, but eventually he decided in favor of central-station service. Many inquiries are being received by the Stillwater division from farmers desirous of using electrical energy for both lighting and motor purposes, and a considerable increase in this class of business is expected next spring.

Southern California Edison Company's Method of Disposing of Electric Appliances

By S. M. Kennedy

Any central-station man who has carefully and constantly watched the development of the electric appliance business from its inception to the present time, who has schemed and planned to arouse public interest and increase the number of appliance sales among his customers, must surely have established a theory on this subject which theory would gradually become a conviction. He will eventually conclude that there is some means or method by which every man or woman can be interested in any appliance of real merit and induced to install one in his or her home.

Advertising, whether newspaper, program, street car, billboard or circular, has a distinct advantage in attracting attention and awakening interest in an article, but advertising in itself does not obtain many signatures to agreements and orders. It must be followed up by personally presented proposals in order to make sales. Appliance-selling campaigns have developed many and varied plans to induce purchases, and each plan has been followed by more or less satisfactory results. Each successive scheme, if legitimate and properly presented, has brought into the fold some consumers who had hitherto held back, but it has left others out in the cold, awaiting some different proposal to warm their interest and make them feel that the ownership of the particular appliance presented is necessary to their comfort.

Of all the electrical appliances which have been produced for use in the home up to the present date, the electric flatiron is the best beyond all question. It has passed through a dozen years of evolution until it has reached a degree of perfection which it will be difficult to exceed in type, efficiency or durability. The best evidence of this is that some of the leading manufacturers now give guarantees of ten years or longer on all the irons they are sending out. No other electric appliance consuming the same amount of energy is as constantly used in the home or gives as much satisfaction to the user when in operation. Nothing but enthusiastic indorsement is heard regarding its claim for comfort, convenience and utility. Other electrical devices for home use have appeared with recurring regularity, some to stay and others to go, but so far not one claims to rival the electric iron in importance, utility and popularity. The wonder is that throughout the length and breadth of the land every householder does not possess an electric flatiron, if he or she is within reach of an electric service. None is so rich that he can afford to overlook his need of this unique piece of apparatus, and none so poor that he would not find it real economy to make a sacrifice to own one. And still, perhaps through the carelessness or fault

of the nearest central-station company, there are some rich, some middle-class and some poor persons who are pursuing old methods for ironing, using up their strength and wearing themselves out with unnecessary work, because the central-station company has not yet demonstrated to them what they need, what they are missing and how to get it.

The sales manager of a central station who says he has sold 10,000 electric flatirons to his company's customers may have good reason to be proud of his achievement, but if his company has 40,000 residence customers, that sales manager has still a lot of work ahead of him, because each and every one of those 40,000 consumers should possess an electric iron. The same methods used in selling the first 10,000 may not be successful in reaching the remaining 30,000, but they all can be reached, and in time all should be reached, and the sooner the better for the consumer and the electric company. The day will come when every residence customer will require an electric iron for the kitchen equipment, just as much as electric lamps for the fixtures, and in some parts of the country this is close at hand.

The Southern California Edison Company has been vigorously exploiting the lamp-socket appliance for eight years and has placed with its customers through its own organization during the past three years alone a total of 70,000 appliances of approved types, whose consumption averages from 4 amp to 6 amp each. The total number in use on the company's system, with approximately 90,000 residence consumers, exceeds the 100,000 mark.

This company recently estimated that more than 85 per cent of its residence customers were using electric flatirons, either purchased directly from the company or sold by dealers. With a permanent force of appliance salesmen, making house-to-house calls at regular intervals, the public had had plenty of opportunity through explanation and demonstration to learn how the electric energy in their homes could be utilized for good purposes other than lighting. Irons had always been freely sold on straight cash sales. They had also been put out on trial, sold on instalments, loaned for limited periods, and in fact every effective method had been adopted to induce permanent use, except actually giving them away, and yet nearly 15 per cent of

FIG. 1—COFFEE POTS TAKEN IN PART PAYMENT FOR ELECTRIC PERCOLATORS

the company's customers were still holding back and using old methods and appliances for ironing. The 15 per cent were still to be converted, but how?

It was found in many instances that the old irons which some consumers were using were blocking the sale of the new electric irons. In other words, many customers were waiting for their old irons to break, wear out or be lost or stolen before they would invest in one of the modern electric contrivances. This created an opportunity, and the company has taken advantage of it. A campaign was inaugurated upon an exchange basis, the company taking the old iron no matter the make, size, type or condition, and accepting it as part payment on the purchase of a new electric iron. The retail price of standard makes of electric

FIG. 2—IRONS OF ALL SORTS TAKEN IN PART PAYMENT FOR ELECTRIC IRONS

irons is $3.50, and an allowance of 50 cents apiece was made for the old sadirons or other irons exchanged. The accompanying illustration (Fig. 2) demonstrates how well the plan worked. The stack shown contains 2700 irons altogether, including not only ordinary sadirons but also gas, gasoline and coke irons, and the total result of a three months' campaign will be more than 3000 additional irons put out. The company intends to keep at the promotion work on irons until every single one of its residence customers is supplied, even if the last and most stubborn of its customers must have the electric irons presented to them free, and a bonus paid them for the antiquated smoothers which they seem to love and cherish so pathetically.

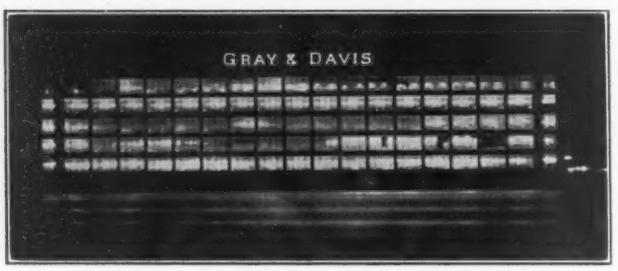
In the opinion of many, the electric coffee percolator is next to the flatiron the best lamp-socket appliance from the central-station standpoint, and, of course, from the consumer's standpoint also. In almost all households in this country coffee is used once each day; in many it is used twice daily, and in not a few it is prepared three times every twenty-four hours. The electric percolator makes it easy to serve good coffee with the least amount of trouble and at a minimum amount of expense. That is where it pleases the consumer, and that is why it is always used after its advantages are understood. In the regular use of the percolator one or more times each day advantage comes to the central station and demonstrates the electric percolator to be of much greater importance than other appliances which are used irregularly or infrequently, even though the latter consume more energy while in operation.

With this in mind, the Southern California Edison Company has followed the iron exchange campaign with a coffee-pot exchange plan which has been in operation about two months and bids fair to reach considerable proportions. Fig. 1 shows a pile of more than 200 coffee pots of various makes and materials, each of which has been replaced by an electric percolator. In six weeks' time 600 of these exchanges have been made, and it is confidently expected that when all the territory has been covered the company will have taken in 1000 old coffee pots and have operating in their stead 1000 additional electric percolators. The retail price of the electric percolator is $6, and $1 is allowed for the old coffee pot when taken in exchange.

Illumination and Wiring

Noteworthy Lighting of a Factory at Cambridge, Mass.

One of the most striking examples of factory lighting from central-station mains in New England is illustrated herewith from a photograph recently taken at the new plant of Gray & Davis, Cambridge, Mass., manufacturers of



LIGHTING OF FACTORY BUILDING AT CAMBRIDGE, MASS.

automobile electric starting and lighting systems. The factory building is 360 ft. long, 60 ft. wide and five stories in height and fronts on the Charles River Basin, directly facing the outer Back Bay district of Boston, where it is in full view of important electric and steam-railway lines entering the city. The electric-lighting installation consists of 490 tungsten and ninety-five graphitized-filament lamps, and all of these were thrown into service when the photograph was taken. The ninety-five graphitized-filament lamps are of the 50-watt size, and the 490 tungsten lamps are divided among twenty-three 40-watt, twenty-four 60-watt, ninety-seven 100-watt and 346 150-watt units, all operated on a 110-220-volt distribution system.

The large sign bearing the name of the firm at the top of the factory is 100 ft. long, with letters 8 ft. high, and contains about 300 5-watt, 12-volt tungsten lamps. A search-lamp platform has been erected on one corner of the building for advertising purposes, the projector having a sweep of about 5 miles radius.

Inside the building the general lighting is effected by four 150-watt lamps per bay, there being nine bays, roughly 19 ft. square, on a standard floor on each side of the central aisle. Down these aisles single rows of lamps are run. Extensive use is also being made of three-phase induction motors operated from a 550-volt distribution system. The plant at present occupies 140,000 sq. ft. of floor area. It is of reinforced-concrete construction throughout. The entire electrical service is furnished by the Cambridge Electric Light Company.

Registration of Contractors and Municipal Inspection

The Chicago ordinance requiring the registration of persons engaged in electrical construction went into effect on Oct. 1. The provisions of the ordinance were explained in the *Electrical World* of July 19. While the ordinance was passed primarily for the purpose of protecting the public against the work of so-called electrical contractors, it is expected that there will be a decided decrease in the average cost of inspections made by the electrical inspection department of the city. According to the report of the department of electricity of Chicago for the year 1912, there were 98,414 inspections made at a cost of $74,812.08, making the average cost per inspection about 76 cents. The inspections are charged for according to the number of lamp outlets or motors connected to the system. When the work of installing electrical equipment is done by an incompetent person, it frequently becomes necessary for the bureau to make several additional trips of inspection. On one occasion where a twelve-lamp installation was inspected it was necessary to make fifteen trips before the work was in condition to comply with what was considered good practice. As each one of these trips cost on the average 76 cents and the fee was only $1.20, it can be seen that the elimination of the incompetent electrical worker will considerably reduce the expenses of the electrical inspection bureau.

Heretofore it was the custom for the regular inspectors to report cases where no permit has been obtained, and it was necessary for the chief inspector to obtain a witness to the regular inspector's statement regarding the evidence, and all three had to appear in court to prosecute the case. As the exact time at which the case would be brought up before court was never known beforehand, and as each case was sometimes represented by a different inspector, the arrangement resulted in poor efficiency.

With the new arrangements, however, it will be the duty of the special inspectors to receive notices of violation from the regular inspectors and to obtain evidence and appear in court for these cases. During previous years the bureau has spent several times as much as it gets through fines to conduct the prosecutions.

There are two additional features which are of value in the new ordinance. The inspection bureau is provided with signatures of all men supervising electrical construction on whom it can place the blame of poor workmanship executed under their care. The second feature is that the bureau will be able to inform the contractors of any changes in the rules regarding electrical inspection. Not having had any definite mailing list previous to the passage of this ordinance, the bureau was unable to notify all of the contractors, and several who had been accosted for violation of rules said that they were ignorant of the changes. Under the present arrangement all of the registered contractors will be on the mailing list, and others who may claim ignorance of the rules are violating the ordinance because they have not registered.

Illuminated Sky-Line Float in Dallas

Electrically illuminated floats in night parades always command attention, and if any particular novelty or ingenuity is manifested in the design or effects produced they are sure to excite admiration also. Floats of this character have won the plaudits of spectators in various festivals in the Pacific Coast States and in St. Louis, New

ELECTRIC-LIGHTED FLOAT IN DALLAS JOVIAN PARADE

Orleans and elsewhere. A recent example was furnished by the night parade on Jovian and Electrical Day in Dallas, Tex., Oct. 31, to which reference has previously been made. This night parade was in charge of Mr. R. W. Van Valkenburgh, grand marshal, and was formed in four divisions. The second division included decorated floats. A novel

GRIPPER AND SIDE GUIDE

illuminated float in this division was that of the Southwest General Electric Company, illustrated herewith. It represented, in models of wood and cardboard made to scale, the buildings and sky-line of Dallas for a distance of two blocks, from the Adolphus Hotel on the left to the post office on the right. The windows of these building models were of oiled cloth and were electrically lighted. There were also miniature street lamps shown burning on the streets and models of street cars and automobiles. The legend on the float was "Modern Dallas Impossible Without Electricity." This attraction represented considerable work and ingenuity and was heartily greeted. Prizes were awarded to the Southwest General Electric Company and also the Abright Electric Company and the International Brotherhood of Electrical Workers for their floats. Fully 500 electrical men marched in the parade on foot.

Ruling on the Service Requirements of the New York Electrical Code

As the result of conferences on evidence secured in the investigation of a number of electrical fires, Commissioner Henry S. Thompson of the Department of Water Supply, Gas and Electricity, New York City, has made the following ruling upon request of the conference, which represented the electrical inspection services of the Underwriters, the electric-light companies and the city.

It is understood that this interpretation involves no change in the Electrical Code and shall not be retroactive except in cases where dangerous conditions appear to exist.

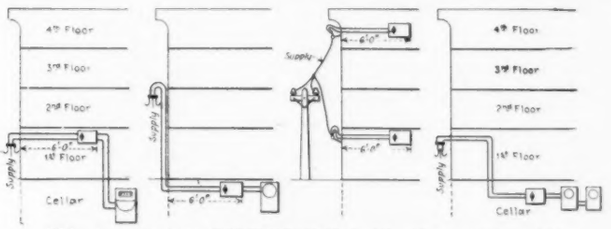


FIG. 1—SERVICE REQUIREMENTS OF NEW YORK CODE

1. Service conduits or metallic coverings protecting service wires must be electrically separated from the conduit system in the building.

This metallic pathway may be broken by the porcelain service switch or by insulating material, such as fiber or transite board, so installed as to provide a separation and insulation between the incoming service conduits or metallic coverings and the interior electric system.

It is suggested that a connection between the service conduit or metallic covering and the neutral wire of a grounded system on the street side of service switch be permitted if desired, and it was requested that, if adopted, the above would not be made retroactive but would apply to future installations only.

2. New-code conduit wire may be used for service connections provided the service conduit does not enter the building more than 6 ft. In case the conduit is concealed or is extended beyond the 6-ft. limit, it is recommended that the wire used in same be provided with an additional 1/64 in. of rubber or be protected by an additional 1/32 in. braid over each conductor or multiple conductor.

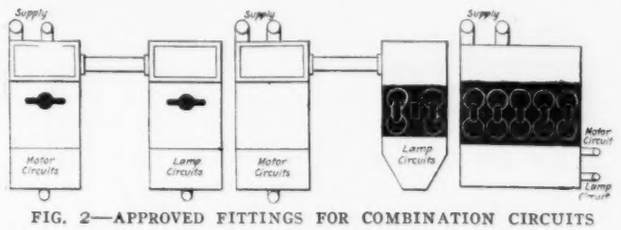


FIG. 2—APPROVED FITTINGS FOR COMBINATION CIRCUITS

3. All wires entering a building and constituting source of supply shall be carried through approved service devices. This will permit of all wires entering buildings being controlled either by one device having the requisite number of connections or by two or more approved devices so installed that when any one is operated the entire installation depending upon that circuit will be entirely disconnected.

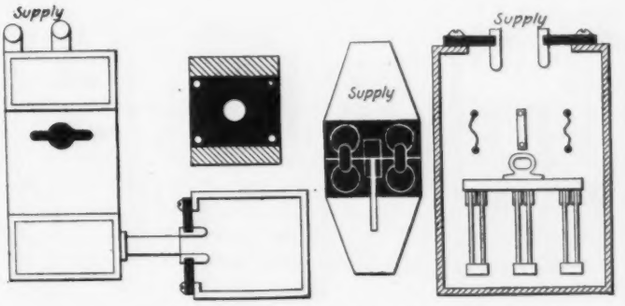


FIG. 3—FITTINGS APPROVED BY NEW YORK CODE

4. Fuse protection must be provided as called for in the rules of the National Electrical Code and the Electrical Code of the City of New York at a point where connection is made between all branches and main feeders, or as near thereto as possible. A neutral fuse will not be required at this point provided the circuits are fused on house side of meter, as called for in the codes.

5. Where two-wire meters are installed on three-wire circuits and the neutral system is grounded, the loop connecting the two outer wires must be on the meter side of the three-pole cut-out protecting the three-wire branch circuit.

In case the neutral is not grounded, a three-wire meter must be installed in order that all three wires of the final branch circuit shall be protected by proper fuses.

In cases where the final branch circuit is properly protected by the cut-out in the meter case, no additional cut-out on the house side of the meter will be required.

The accompanying diagrams illustrate some of the service conditions which were investigated.

Elements of Cost in Street Lighting

At the convention of the Illinois State Electric Association held at Quincy, Ill., recently, Mr. S. B. Cushing, statistician of the Public Service Company of Northern Illinois, read a paper entitled "Cost of Operating and Rates to Municipalities for Series Street Lighting," in which he commented on present inconsistencies in street-lighting rates in Illinois, declaring it likely that some are as much too high as others are too low. Uniformity in rates becomes especially important where a company deals with several municipalities.

Incandescent street lighting is now coming to the front, following the introduction of a rugged type of tungsten lamp. In fixing proper rates to charge for this class of service items of expense should be studied in detail. Starting with the generating station, the annual cost per kilowatt of rating must be obtained and then applied to the wattage of the lamp or lamps installed at each location, making due allowance for the efficiency of the distribution system. This process should be repeated in case there is a substation. Due allowance should also be made for the fixed charges on special equipment for street lighting, like constant-current regulators or rectifying outfits. Fixed charges on pole-line investment can be obtained by considering the miles of wire devoted to street lighting, with the proportional part of the cross-arm space occupied. To physical items of cost must then be added,

GRIPPER AND SIDE GUIDE

Mr. Cushing said, invisible expenses, such as the cost of collecting bills from municipalities, time required in obtaining rights-of-way, and outlays for trimming or removing trees. Proper allowance should also be made for property and personal-injury claims caused by street-lighting circuits.

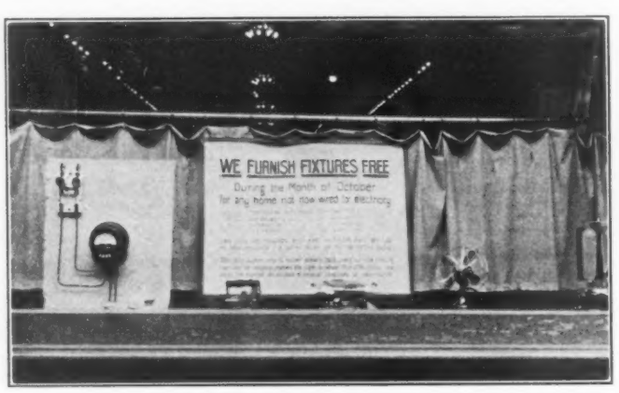
Tungsten lamps consume only small quantities of energy and if put on a kilowatt-hour basis the rate would be higher. After including the foregoing items the actual kilowatt-hours may be sold at the rate of 5 cents per unit until midnight for all street-lighting lamps up to 60 cp and below three-lamp clusters, and at 4 cents per kilowatt-hour after midnight for all three-lamp and four-lamp clusters in case the lamps are 60 cp or more in size. A rate of 3 cents per kw-hr. may be made for three-lamp and four-lamp clusters containing lamps of 60 cp or larger, the lamps burning from 2 a. m. to dawn. A rate as low as 5 cents per kw-hr. must not, however, be considered unless all of the items of cost mentioned—investment in lamps, lamp renewals, general expense, etc.—have been taken into account.

Mr. Cushing advocated abandoning the use of the moonlight schedule wherever possible. Such a schedule costs the municipality nearly as much as the every-night schedule, and is always a cause of controversy. It is advisable to have as few schedules as possible, and three are recommended: From dusk to midnight, from dusk to 2 a. m., and from dusk to dawn. Mr. Cushing's company has found that the expense of operating lamps from dusk to midnight is 80 per cent of the cost of operating them from dusk to dawn. Municipalities should spend the extra 20 per cent for police protection and to advertise the town. Lamps smaller than 60 cp should not be used for street illumination. Where more than one lamp is required a cluster of three 60-cp lamps may be used. If more than 180 cp is required at any location, three 80-cp lamps should be used, as it is recommended to increase the size of the lamps rather than the number in a cluster.

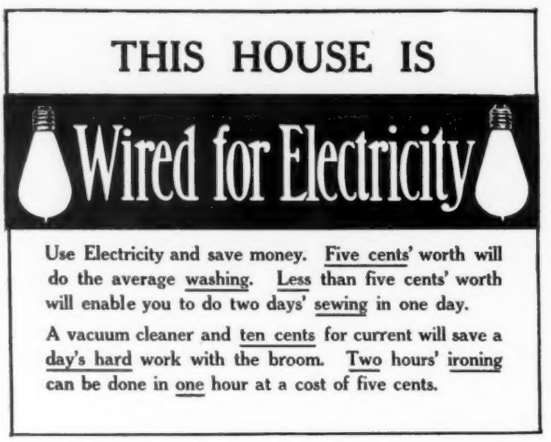
There should be no rebates for outages unless the lamp or lamps have failed to burn during two successive nights. This gives the company one day in which to remedy the trouble, and on the following night its inspectors are able to examine the work.

Free Fixtures During House-Wiring Campaign

With the co-operation of local real-estate dealers and wiring contractors, the Manchester (N. H.) Traction, Light & Power Company is pushing a successful house-lighting campaign this fall. Throughout the month of October the company furnished free fixtures for any house on its lines remaining unwired. Local contractors were also instructed to install new wiring on this basis, the company meeting the fixture cost. In each case the prospective user received a choice of several neat and attractive fixture styles. To all real-estate dealers and to the landlords of wired houses on the market the company furnished 11-in. by 13-in. placards as illustrated, emphasizing



WINDOW DISPLAY DURING MANCHESTER WIRING CAMPAIGN


THIS HOUSE IS
Wired for Electricity
Use Electricity and save money. Five cents' worth will do the average washing. Less than five cents' worth will enable you to do two days' sewing in one day.
A vacuum cleaner and ten cents for current will save a day's hard work with the broom. Two hours' ironing can be done in one hour at a cost of five cents.

WINDOW CARD USED AT MANCHESTER, N. H.

the economies and labor-saving capabilities of electric washers, motor-driven sewing-machines, vacuum cleaners and electric irons. The wiring campaign was also featured in the company's show window, where a residence-type meter, main switch and fuses were wired to various appliances in operation to show the prospective customer the simplicity of electric service.

Letter to the Editors

Rates for Electric Service

To the Editors of the Electrical World:

Sirs:—In his lengthy communication on the subject of "Rates for Electricity" in your issue dated Oct. 25, 1913, Mr. Percival R. Moses has stated a number of facts regarding existing conditions surrounding electric service, but he pretends to ignore the reasons why some of the conditions are necessary. His criticism is of the destructive order rather than constructive. He would tear down methods which have been evolved from years of experience in a comparatively new business, and yet he suggests only a flimsy basis upon which to build what he probably deems an unassailable system.

A comparison is made between the simple method of charging for gas service, on the one hand, and the complex method of charging for electricity. Now, there are several reasons why there must be different methods of charge for these commodities, the principal reason pertaining to methods of generation. Gas may be manufactured at any suitable time of the day or night and stored until the consumer desires to use it. Electricity cannot be stored, except to a limited extent and at great expense, and consequently must be manufactured the instant it is required. The generating capacity of a gas plant may be much less than the "peak" of the load, but the generating capacity of an electric plant must always be at least equal to the "peak." We speak of supplying gas or electric service. "Service" refers not only to the commodity supplied, but also to the availability of the supply. The generating capacity of a gas plant does not bear the same relation to each consumer's demand as does the generating capacity of an electric plant. Gas may be conveniently stored and electricity cannot.

After referring to the simplicity of flat-rate systems of gas companies, Mr. Moses proceeds to attack the present

methods of charging for electric service. It is probable that no perfect method of charging for electric service has yet been developed. If one had been developed, so that each individual consumer would be charged for service in exact proportion to the cost of delivering the energy consumed, it is possible such a method would be found impracticable in operation.

A really scientific schedule of rates is supposed to follow the cost for each class of service, so that no class will be paying for any portion of service supplied to some other class. Mr. Moses has intimated that some of the largest consumers of electric energy are paying for service at such low rates that the loss must be made up by the smaller consumers who are paying the highest rates. As a matter of fact, the experience of the majority of companies is that the most unprofitable class of service is that supplied to the small consumers at the maximum rates, and if the cost were followed in all the schedules, some consumers would have to pay as high as 25 cents per kw-hr., because of the small consumption in proportion to the expense of delivering the service. However, rate-regulating bodies have more or less firmly intimated that the small consumer must be protected, and in fixing the maximum rates to be charged for service in any locality many regulating bodies have had in mind the idea of allowing the little fellow to get his service as cheaply as possible without putting too great a burden upon the electric company, which burden, of course, would have to be borne by the larger consumers. It is recognized by those interested in the electrical industry that the maximum rates are fixed with an eye more to expediency than to scientific regulation.

There are three fundamental factors which form a basis in charging for electric service, namely, quantity, demand and hours of use. The circumstances and conditions surrounding the supply of electric service differ more or less in the case of each individual consumer, though there are certain characteristics which are constant in all installations in which the uses of service are similar. For lighting service the quantity of energy consumed should not alone govern the rate per kilowatt-hour. The demand each consumer is liable to make upon the company is of equal importance, and the relation of kilowatt-hours used to the maximum demand is the most important factor in justifying variations in lighting rates. The sale of electric energy for motor service develops a greater number of variations in uses than for lighting. Experience has demonstrated that these variations in use may be summarized as follows:

First—Optional service: Service that the consumer may take at any time of the twenty-four hours according to his necessity and convenience.

Second—Daylight service: This service covers such industrial business as takes energy only through the ordinary working hours of the day, using no energy after 5 p. m.

Third—Twenty-hour service: Service used constantly except during the four hours of the evening peak.

Fourth—Continuous service: Service used every hour of the day, which means continuous use of a portion of the central-station plant's equipment.

Fifth—Valley service: Service which is used only between midnight and 6 a. m.

Sixth—Seasonal service: Service usually taken for a limited number of months during each year.

Seventh—Wholesale service: Motor service sold to other companies or to municipalities for re-sale.

Eighth—Emergency service: Service used as "standby" to private electric, steam or gasoline plants.

In these classifications no reference has been made to the factor of demand, which must be entered into when the question of rates is under consideration. With some companies there are other reasons which contribute to the necessity for deviations, such as proximity to point of generation, delivery of energy from high-tension lines, consumer paying for line extension and substation equipment, temporary contracts for surplus water-power, experimental work, and other special conditions differing from the characteristics of general service.

Mr. Moses has attempted to puncture almost every present method of charging for electric service. It would appear as if those who have honestly tried to frame just and equitable schedules have utterly failed, mostly through ignorance. Students and experts who have made a study of costs of generating and delivering energy have apparently miscalculated the expenses of distribution when framing schedules for various classes of service. And yet some of the electric companies and public utility commissions have in their employ what has been considered the best talent available. Theory and practice have been combined and the belief has prevailed that great progress has been made.

Rate-regulating bodies are agreed that there may be discrimination in charging for electric service as between the different classes of customers supplied, but that there shall be no discrimination between individual consumers of the same class. Public utility commissions have officially recognized that demand, load-factor, hours of use and quantity are conditions which justify variations in charging for service. Mr. Moses' statement to the contrary notwithstanding, some companies have attempted to determine the cost of supplying different classes of service and believe they have in a measure succeeded. The trouble with the line of contention adopted by Mr. Moses is that he would treat the selling of electric energy like ordinary merchandise. As a matter of fact, there is little resemblance between the two. Conditions of supply and demand between a company and its various customers show much variation, and there is a marked variation between the conditions under which different companies operate in different localities. Hence the impracticability of having the same rate schedules, lamp practices and service conditions in effect all over the country.

The majority of electric companies have in their employ engineers who can calculate the cost of delivering service under stated conditions. They can also tell the cost under average conditions, but in these days averages are not considered as proper bases for rates. The schedules must now follow the cost.

Apparently Mr. Moses' shafts are aimed principally at companies selling energy for motor service to large consumers at low prices, and he seems to think this practice is carried so far that frequently large consumers are supplied with service at less than actual cost. Those who have to do with rate fixing in most of the larger companies know the actual cost of delivering energy to any large consumer when the conditions of demand and consumption are clear. There may be exceptions, but as a rule large loads at comparatively low rates are not only profitable in themselves but such loads help to reduce average costs and enable a company to supply average consumers at rates lower than would prevail if the loads of larger consumers were not carried by the central station. And because of its lower costs of production, on account of the size and diversity of its load as a whole, the central station is in a position to deliver electric energy profitably to the larger consumer at a lower cost than the large consumer could in most cases make it from a plant of his own.

It would be folly for any electric company to supply service to a large consumer at less than cost just to get the business. The company would be loading itself down with an unnecessary burden. Moreover, any other consumer could lodge a complaint with the public utility commission regarding the rate charged for such a service, and the company would be required to justify the rate and demonstrate to the commission that the service is not supplied at a loss but is carrying with it a reasonable profit.

Los Angeles, Cal. S. M. KENNEDY.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Unusual Substation Accident

A severe and rather remarkable accident happened at the Harding Avenue substation of the Commonwealth Edison Company during a recent noon hour. This substation is owned and operated by the electric-service company, but its output is sold exclusively to three elevated and surface railway companies. It is at present equipped with one 4000-kw Westinghouse rotary converter of the commutating-pole compound type, converting 25-cycle, 9000-volt alternating current into 600-volt direct current.

The substation switchboard is equipped with three busbars, one main bus, an auxiliary bus and one used for testing. The last-named affords a convenient means for testing the main recording wattmeters of the various railway companies and is often used for that purpose. At the time of the accident construction work was in progress to unite the two existing sections of this test bus with an intermediate section. Two or three men were engaged on this job, which was in progress partly on the first floor of the station and partly in the basement. Canvas was wrapped around the live parts of the busbar, and all the usual precautions were taken by experienced men.

Taking the piece of copper made ready for the connection, two of the men, Alfred A. Warner and Lawrence Giraffe, went back of the switchboard on the main floor to check up the measurements. While they were in there a loud explosion was heard and flames burst out with quantities of smoke. The two men ran out with their clothing on fire. They received immediate first aid and were removed to a hospital as soon as possible. Both men were badly burned. Mr. Warner died a few hours after the accident, but it is expected that the other man will recover.

In some way, it appears, a contact was made between the main lead from the rotary to the switchboard and the metallic work in the building structure. The resulting burn-out was very severe. The chief operator of the substation, Mr. James Milligan, was left to grapple with a very serious situation, while the other men who happened to be in the building took care of the injured men. The short-circuit on the machine lead was between the rotary and its switch and circuit-breaker. The trouble so reduced the voltage that the no-voltage release of the main circuit-breaker was tripped and thereby disconnected the rotary from the busbars. However, the draft of current was not sufficient to open the oil switch controlling the energy supply to the rotary converter, so that the machine ran on still pumping energy into the short-circuit. The operator diagnosed the trouble correctly and operated the control switch, thereby opening the oil switch of the rotary converter and cutting off the source of supply. This was done in a few seconds.

The strain on the insulators supporting the cable rack from the frame of the building was great, owing to the short-circuit, and some of them broke down, developing arcs between some of the section feeders and the framework supporting the cable rack. These were not heavy arcs and possibly they were due to molten metal. These arcs received the next attention of the operator and were extinguished. In the meantime a considerable fire, started by the burning canvas, was in progress. The operator next turned his attention to this and put out the flames with the fire-fighting equipment provided by the company in all stations and substations.

With the equipment under control, Mr. Milligan's next task was to examine the apparatus to see if it would be safe to put it back into service. At nearly the first moment of the accident he had notified the load dispatcher downtown by telephone, so that in turn the railway companies were advised to make temporary provision through the feeding network, should this be necessary. Things in his own substation were in pretty bad shape, but nevertheless the operator was satisfied that the machine would stand up to its work, and he had it back in service carrying its load within twenty minutes from the time of the explosion.

Mr. E. F. Smith, superintendent of substations of the Commonwealth Edison Company, says that Mr. Milligan's performance was one of the best displays of courage, combined with promptness, accuracy and well-directed activity, that have come to his attention since the establishment of the substation system. There was no interruption to the service of the railway companies.

Oil-Burning Furnaces—II

By R. T. Strohm

A form of furnace construction used in connection with a Heine water-tube boiler is shown in Fig. 1. The bridge wall is torn out completely and the whole floor is brought to the level of the bottom of the ashpit. On this surface two layers of firebrick are placed, as at *a* and *b*, separated by bricks *c* laid on edge and so supported as to leave an air

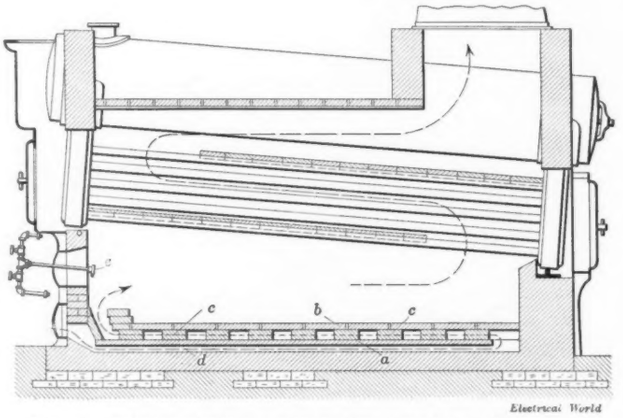


FIG. 1—HEINE BOILER WITH PREHEATING OF AIR SUPPLY

passage *d* underneath the lower layer. The air supply enters through the ashpit doors, flows to the back end of the boiler through the passage *d*, then forward between the layers *a* and *b*, and escapes, highly heated, into the furnace just beneath the burner *e*. The burner is of the slot type and throws a fan-shaped flame that spreads to the sides of the furnace. The inclination of the burner is such that the flame is about parallel to the rows of tubes.

The Stirling water-tube boiler arranged for burning oil with a Best burner is shown in sections in Fig. 2. The grates are removed and the sloping floor of the furnace is covered with firebrick laid flat in rows 9 in. from center to center. On top of this firebricks are laid on edge and 9 in. from center to center. The top layer of firebrick is

laid flat, with ¼-in. air spaces; thus the air supply is admitted over the whole bottom of the furnace after being heated by contact with the brickwork. The burner *a* is inserted through the front wall about 8 in. above the grate and parallel thereto, the tip extending into the furnace about 2 in. Over the tip is constructed a firebrick arch *b* forming an igniting chamber. The arch is brought to incandescence by the heat of the flame, and in case the action of the burner is momentarily interrupted, as by a slug of water carried over with the oil, the spray will be reignited by the hot brickwork when the burner continues its operation. The bridge wall is constructed with a firebrick facing and a flared top, so that the flames striking into the pocket thus formed are turned back on themselves. This is done to prevent the flames from striking directly against the tubes. An auxiliary air duct *c* is formed in the bridge wall. It connects with the passages beneath the furnace floor and admits air to the upper part of the flame when the fires are being forced. At such a time there is a tendency to form carbon monoxide at the top of the flame, and the air admitted through the duct *c* supplies the oxygen required to convert this to dioxide. The arch *d* is retained and serves to deflect the gases toward the front bank of tubes.

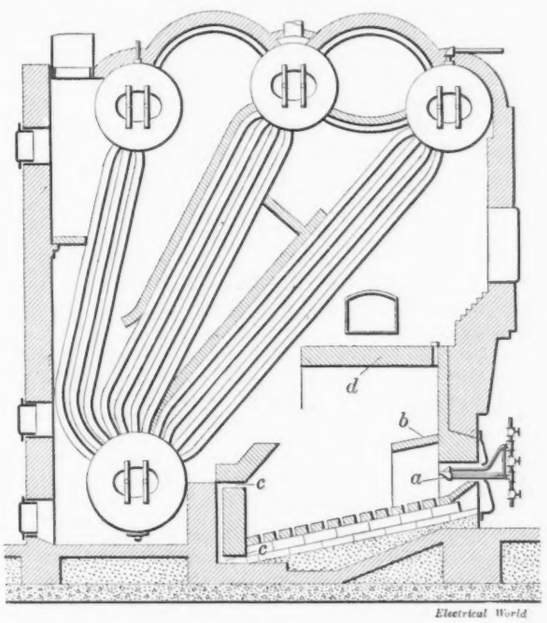


FIG. 2—STIRLING BOILER WITH AUXILIARY AIR DUCT

If desired, the burner can be put at the rear end of the furnace, as in Fig. 3. The arrangement in this case is like that for the Babcock & Wilcox boiler fired from the rear. The air ducts are formed beneath the floor, there being one for each burner, and the burners are protected somewhat by being set in recesses in the bridge wall. The arch over the furnace is omitted, and the front wall is heavily protected with firebrick.

One way of altering the usual furnace construction of the Stirling boiler so as to adapt it to the use of oil fuel is shown in Fig. 4. The rear half of the grate is removed and a brick pier *a* is substituted. A firebrick floor *b* is built over the top of the pier and the remainder of the grate surface, and air spaces from ¼ in. to ½ in. wide are left between the bricks on the grates. The arch usually found inside the furnace, above the firedoor, is removed entirely, because the burner *c* is installed at about the height of the top of this arch. The burner is of the slot type and is inclined so as to project the flames downward into the angle or pocket formed by the firebrick floor *b* and the bridge wall *d*. The flames thus are given a rebound before they enter the first pass among the tubes. The air enters through the space below the grates and flows up through the space in the brickwork into the furnace.

From an examination of the settings that have thus far been described the following conclusions may be drawn: The furnace of an oil-fired boiler, particularly in those parts against which the flames strike, must be lined with a good quality of firebrick so as to protect the outer walls and the boiler and to resist the high temperatures produced. There should be a combustion chamber of ample size, in which the gases and the air may meet and commingle thoroughly, so that combustion may be complete before the resulting products of combustion are brought against the comparatively cool boiler surfaces. If combustion is not completed before the gases strike the metal parts of the boiler, the consequent chilling will prevent further combustion and cause smoke to be formed. If it seems likely that the flames will strike the boiler, baffles or arches should be set up to prevent direct contact. This is particularly necessary in the case of the blow-off pipe of a return-tubular boiler, when the blow-off is carried straight down through the gas passage at the rear end of the boiler. It is advisable to preheat the air supply before admitting it to the furnace.

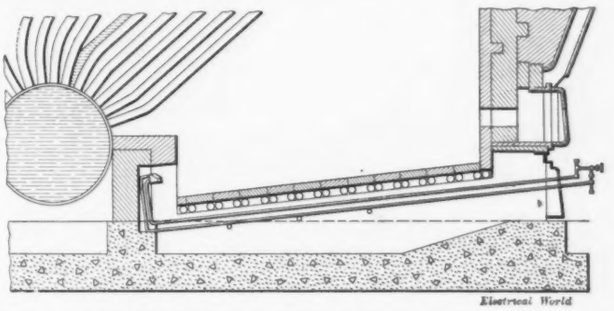


FIG. 3—STIRLING BOILER WITH BURNER AT BACK OF FURNACE

Oil fuel is used as an auxiliary to coal in some cases. In one electric power station oil burners are installed with the idea of helping out on peak loads and for the purpose of banking the boilers. The arrangement of the furnace of one of the boilers is shown in Fig. 5. At the front there are the usual grates *a* on which coal fires are carried for the normal operation of the boilers. Behind the bridge wall *b* the burners are installed, as shown at *c*. The combustion chamber for the oil is formed by the baffle *d*, the floor *e*, the wall *f*, and the side walls of the setting. After combustion, the hot gases from the oil burner pass forward over the bridge wall and travel along with the gases rising from the grates. The air supply to each burner is admitted through the passage *g* that contains the steam and oil pipes.

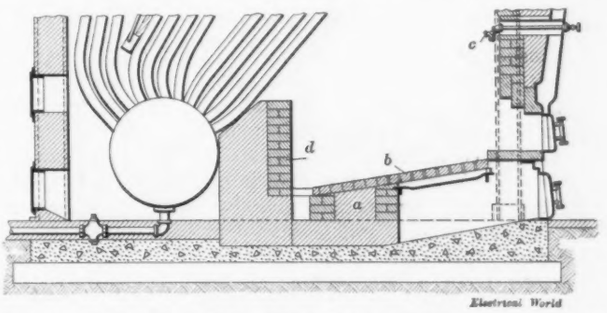


FIG. 4—STIRLING BOILER WITH OIL BURNER SET HIGH AT FRONT

By this arrangement it is possible to fire the boiler at both ends, using coal and oil at the same time. The result is the same as would be obtained by increasing the

rate of combustion with coal alone; that is, the steaming capacity of the boiler is greatly increased. Of course, the oil burners are used to supply the additional steam demanded by a peak load. Under normal load the coal fires only are used; but as soon as a sudden increase of load comes on the oil burners are put in action, and in a very short time the capacity is equal to the increased demand.

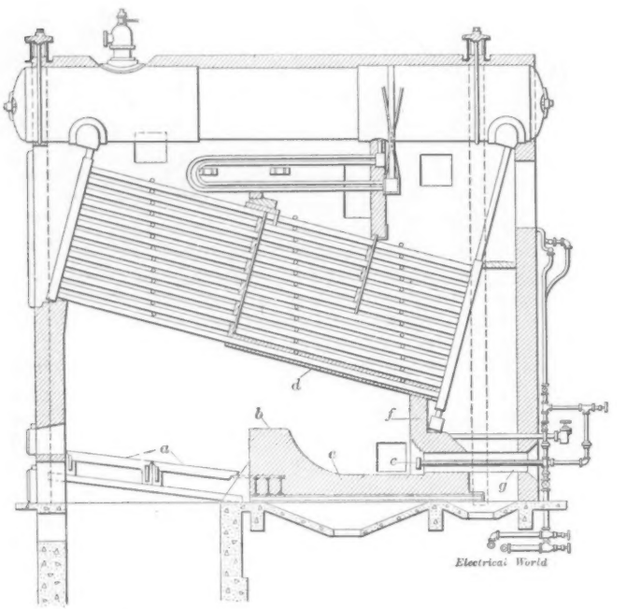


FIG. 5—OIL BURNERS USED AS AUXILIARIES TO COAL FIRING

This rapidity of response to sudden changes of load forms one of the strongest advantages of oil fuel. By adopting the scheme here outlined the boiler-horsepower may be increased two-thirds, without increasing the number of boilers.

During periods when the load is light oil is used to bank the boilers. There are four burners to each boiler, and one of these is connected so that it can be operated independently of the others when the boilers are to be banked. At this particular plant the oil costs more per heat unit than the coal; yet it is found more economical to use oil for banking, because the combustion is more efficient with the oil than with the slow coal fire.

Thin Brushes

An inspector went 150 miles to stop sparking on a 20-hp, 125-volt, shunt-wound four-pole motor. The sparking was almost equally bad for all loads and for all brush positions within the range of the brush-holder rocker arm. The operator stated that the motor was idle for several months after its purchase and also that it had been a bad actor from the start. The commutator had been turned three times in two months and brushes had been consumed by the dozen. Investigation revealed that the motor had been purchased from a second-hand dealer who, presumably, had bought it from the original dissatisfied owner. The inspector put the motor through all of the usual tests to determine soundness of the commutator and the windings and to check the correctness of the brush setting and of the field polarity. All of these conditions proved to be normal. In testing for brush quality, however, the inspector happened to get hold of a set of brushes intended for a smaller motor. On starting and loading the faulty motor with these brushes installed commutation was perfect at all loads. Inspection showed the brushes to be 1/16 in. thinner than those for which the brush-holder boxes had been designed. On chamfering the ends of the original brushes they too gave perfect commutation. Before thinning the brushes the thickness of each spanned three commutator bars; after thinning the brushes each spanned only two commutator bars. It became evident then that the magnetic field had narrow neutrals that called for thin brushes. A motor with this fault could never have passed a running test.

Safety Catches for Disconnecting Switches

Why need generator disconnecting switches be provided with locking catches when their blades are to be installed in such positions that they cannot possibly fall open by gravity? K. N. C.

Safety catches are provided for knife-type disconnecting switches to prevent their blades opening under the action of the self-generated strong magnetic fields which may result from heavy short-circuit currents through the switches. Such disconnecting switches are hand-operated and are intended to be opened only when no current exists. The forces acting to open the switch during heavy currents are due to the interaction of the field about the blade itself with those about other parts of the switch and adjacent circuits. Such disruptive forces may become very powerful, sometimes even tearing busbars and cables from their supports. The safety catch assures that under short-circuit conditions the switch will not fly open. Recent designs of disconnecting switches in which the path of the current is in a straight line through the switch reduce this tendency to self-opening.

Repair of Heating Element

I have a 6-in. electrical hot-plate which has burned out. On taking it apart I found the heating element wound in a helix on a 3/16-in. arbor and the whole covered with something of the nature of cement. To replace the burned-out element I rewound a flatiron resistor as above, bedding it in calcine plaster. It burned out in about an hour. Then I tried a compound composed of asbestos (boiler covering), sand and Portland cement, but with the same result. Fireclay and sand were next tried, and again the wire rapidly corroded or oxidized until it finally burned in two. I cannot understand what there can be in the cements I used which would attack the wire. E. R. R.

The oxidation or corrosion of the wire observed is probably due to overheating caused by the cement coverings used. Instead of providing good thermal conducting paths for the heat of the wire, compounds like the asbestos mixture mentioned are really thermal insulators. Such coverings, as the correspondent knows, are put on steam pipes and steam boilers to keep in the heat and prevent its loss by radiation. The same action results with this thermally insulated resistor wire. As its rate of heat generation remains practically unchanged, while escape of that heat is almost wholly prevented by the covering, the wire inside becomes hotter and hotter until it finally burns, or perhaps corrodes, with the help of corrosive chemicals distilled out of the inclosing cement. The general problem in heating-device design has always been to provide the best possible thermal conducting path from the resistor to the point of use of the heat. Such construction insures that the resistor temperature will not rise far above that of the outside of the appliance and also makes for the most efficient use of the heating energy. But since most of the good electrical insulators are poor thermal conductors, especially those which retain their insulating qualities unimpaired at high temperatures, considerable ingenuity of mechanical design is often required to convey the heat properly from the wire where it is generated. But in the cases brought up by the correspondent the difficulty doubtless lies in the low thermal conductivity of the cements used and their inability to carry away fast enough the heat produced at the high rate at which the flatiron cement is worked.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Alternating-Current Commutator Machines. — F. NIETHAMMER AND E. SIEGEL.—A long mathematical paper on the operation of alternating-current commutator machines, taking into consideration all essential secondary influences. In the ordinary series motor the brush short-circuit currents improve the power-factor and at high speeds even produce phase compensation and leading current. In the double-fed series motors the brush short-circuit currents lower the power-factor when the speed is increased beyond the point of best commutation. The same is the case with all repulsion motors when the speed is increased beyond synchronism. All these statements hold when the machines are operating as motors. When they are running as generators the opposite is true. With respect to overload capacity repulsion motors, whether operated as motors or as generators, are inferior to ordinary series motors. The double-fed series motor behaves in general on overload like the ordinary series motor. Some notes are added on the possibility of braking with recuperation of energy.—*Elek. u. Masch.* (Vienna), Oct. 26 and Nov. 2, 1913.

Noiseless Running of Electric Motors.—S. PONTECORVO.—An illustrated translation in abstract of his recent German paper in which the different kinds of noise in electric motors are divided into three classes—noise due to magnetic causes, noise due to load and noise due to ventilation. Of these the first mentioned is the most troublesome. Means for reducing or suppressing the noise due to the various causes are described and criticised.—London *Electrician,* Oct. 31, 1913.

No-Load Current of Transformers.—M. VIDMAR.—An article, illustrated by diagrams, in which the author gives a very simple and little known method of calculating the no-load current of transformers, taking into consideration the air-gap and any increase of the cross-section of the yoke. The formulas are applied to a practical example. For modern transformer-alloy steel sheets the curve of the no-load current coefficient as a function of the induction is given in a diagram.—*Elek. u. Masch.* (Vienna), Oct. 26, 1913.

Resonance Transformer.—O. NAUMANN.—An article outlining the theory of the resonance phenomena in a transformer having its secondary loaded with condensers. The theory is derived by means of the symbolic method and a number of simple diagrams are given. Some peculiarities due to the presence of iron in the transformer are explained by the results of tests.—*Elek. u. Masch.* (Vienna), Nov. 2, 1913.

Lamps and Lighting

Electric Street Lighting.—L. ROSENBAUM.—The author summarizes in some tables the statistics of street lighting of the Association of German and Austrian central stations. In 1909 the average connected load in incandescent lamps for street lighting in cities with less than 10,000 inhabitants was 14.5 kw per 10,000 inhabitants; in cities of 10,000 to 20,000, 8.4 kw; 20,000 to 50,000, 2.4 kw; 50,000 to 100,000, 1.8 kw, and in cities with more than 100,000 inhabitants, 0.6 kw per 10,000 inhabitants. In other words, the number of connections per inhabitant decreases rapidly with the size of the city. The connections of arc lamps for street lighting in kilowatts per 10,000 inhabitants were 6.6, 7, 3.6, 2.8 and 3.6, for the same sizes of cities respectively. They are less affected by the size of the city than the street lamps. Of considerable interest is the comparison of the figures for 1905 and 1909. In cities with more than 100,000 inhabitants the number of incandescent lamps for street lighting in 1911 was four times the number in 1905 and double the number in 1909, while the number of arc lamps remained constant from 1909 to 1911. The connected load in incandescent lamps increased by 65 per cent from 1909 to 1911, while that in arc lamps rose by only 1 per cent. In thirty-eight cities with fewer than 20,000 inhabitants the connected loads in incandescent lamps were 427 kw in 1909 and 524 kw in 1911, which is an increase of 23 per cent. The load in arc lamps in 1909 was 230 kw and in 1911 233 kw, which is an increase of 1 per cent. In Berlin, where there is competition with gas, the load in incandescent lamps for street lighting increased from 150 kw in 1909 to 187 kw in 1911, and the connections of arc lamps from 704 kw to 711 kw. In Vienna the connections of incandescent lamps for street lighting increased from 105 kw in 1909 to 122 kw in 1911, and the connections of arc lamps from 716 to 815 kw. Another table shows that carbon lamps amount hardly to 10 per cent of all incandescent lamps. The increase in the use of incandescent lamps for street lighting is, therefore, almost completely due to the development of the metallic-filament lamp. Figures are added giving the number of hours per year during which the lamps are used. In general the number of hours per year increases with the size of the city, but the consumption of kilowatt-hours per inhabitant decreases. *Elek. u. Masch.* (Vienna), Nov. 2, 1913.

Rotations in the Iron Arc.—W. G. CADY.—If in an arc between iron electrodes the anode is sufficiently oxidized so that a smooth molten globule of oxide is formed, the positive base of the arc tends to fall into a circular motion, producing the appearance of a minute ring of light at the anode. As the current is increased from about 1.5 amp to 2.5 amp four characteristic types of rotation may be observed in succession, the transition from one type to the next being marked by a distinct and sudden change in diameter and frequency of rotation. This is not the result of artificial conditions but the normal sequence of events in the iron arc as the current increases. The characteristic features of each type, including frequency, amplitude and appearance, are described, and photographic records of the movements at the anode, together with the accompanying fluctuations in voltage and current, are shown. Reasons are given for believing that these rotations owe their existence to a difference between the potential drop at the positive base of the arc and the similar drop in the surrounding region. At the positive base the oxide is more reduced and the potential drop is therefore greater; the high temperature probably enhances the effect still further. Observations with other metals and in other gases tend in the main to confirm the conclusions reached with the iron oxide. Oxides of nickel and cobalt show some evidence of forces similar to those in the iron arc.—*Phys. Review,* October, 1913.

Tungsten for Drawn-Wire Lamps.—A note on a recent British patent (No. 22,041, 1912) of H. Leiser. An intimate mixture of dry powders of the crystalline and amorphous modifications of the metal, in the proportion

of about 16 to 1, is pressed and heated to a temperature far below the melting point of the metal until the amorphous modification is changed into the crystalline.—London *Elec. Eng'ing*, Oct. 30, 1913.

Tungsten Lamp.—Anton Lederer.—An illustrated article giving a sketch of the development of the tungsten lamp.—*Elec. Journal*, November, 1913.

Generation, Transmission and Distribution

Water-Power Plant.—E. Frey and O. Albrecht.—A continuation of their long illustrated description of the Wyhlen water-power plant of the Rheinfelden transmission system. In the present instalment figures of first cost are given together with details of the 45,000-volt and 25,000-volt transmission lines. The article is to be concluded.—*Elek. Zeit.*, Oct. 30, 1913.

Utilizing the Power of the Tides.—Some photographs showing a small experimental power plant erected by Pein to utilize the power of the tides for generation of electrical energy. The object is not the generation of large power but proof that uninterrupted operation is thereby possible. Direct current is generated at 110 volts.—*Elek. Zeit.*, Oct. 30, 1913.

Traction

Effect of Mining on Tramways.—Nolden.—The first part of an illustrated article on the deleterious effects of mining operations on street railways and buildings due to sinking of the ground. Methods of avoiding such damage are discussed.—*Elek. Kraftbetr. u. Bahnen*, Oct. 4, 1913.

Installations, Systems and Appliances

Protective Ground.—G. Ruppel.—The German regulations require that protective ground connections shall be made in such a way that in the surface of the soil surrounding the ground a safe and very gradual potential drop will be produced. From experiments on grounding with rods, plates, ribbons or rails the author concludes that the requirement of a very gradual potential drop can be fulfilled only with great difficulty. In order to eliminate danger the only safe way is, therefore, to make the resistance of the earth connection as small as possible so that in case of an accident either the line will be disconnected automatically or the voltage between the pole and the earth will be so small as to be free from danger. It is shown that by the use of long ribbons or wires or rails embedded in the earth, the resistance of the ground connection can be made as small as desired. This method is recommended for transmission lines in agricultural districts as well as for transformer stations.—*Elek. Zeit.*, Oct. 23, 1913.

Electric Equipment of Building.—An illustrated description of the electric lighting and power equipment of the recently finished new building of the British Institution of Civil Engineers in London.—London *Electrician*, Oct. 24, 1913.

Parallel Running of Machinery with Different Characteristics.—A note on a recent British patent (No. 27,069, 1912) of Brown, Boveri et Cie. Regulators are used which do not maintain constant the value of the quantity to be regulated over the whole range of regulation, but which vary it with the position of the regulating members within the regulating range in a definite sense. For generators working in parallel the main windings of the regulators are fed from the pressure to be regulated, and additional windings are fed by the total current of all the generators.—London *Elec. Eng'ing*, Oct. 30, 1913.

Starting Rheostats.—An anonymous article describing a method of calculating the design of a starting resistor in order to utilize to the utmost the resistor material. To estimate the suitability of a starting resistor knowledge of its cooling curve and continuous load are sufficient, and expensive experiments in intermittent operation are entirely superfluous.—*Elek. Zeit.*, Oct. 30, 1913.

Circuit-Breakers.—J. N. Mahoney.—An article in which the author points out that the breaking-capacity rating of oil circuit-breakers is usually based by the manufacturers on certain arbitrary assumptions and the nature of these assumptions must be known in order to apply the circuit-breakers under different operating conditions.—*Elec. Journal*, November, 1913.

Extinguishing the Arc on Breaking a Circuit.—W. Burstyn.—To interrupt a direct-current arc of medium

FIG. 1—WAVES ON BREAKING CIRCUIT

strength two methods are used. In the first the arc is extended to such a length and its resistance thereby so increased that it is extinguished automatically. The second method employs condensers. With an induction coil, for instance, the switch in the primary circuit is shunted by a condenser. The author shows that when the current is broken a high-frequency circuit is formed by the capacity of the condenser and the self-induction of the leads thereto. This high-frequency current is superposed over the current of the arc. The phenomenon is shown in Fig. 1, where *A* represents the moment of breaking the circuit. The superposed high-frequency current is shown by a dotted line. In the moment when this superposed current becomes equal and opposite to the main current the total flow becomes zero and the arc is broken. This is shown at the moment *B*, in Fig. 1. After that a slow oscillation starts. The conditions which render the extinction of the spark easy are that the contact surface should be metallic. Carbon electrodes are unsuitable. Platinum is not as good as silver. A hydrogen atmosphere gives improved results. Further, the wave-length of the high-frequency current should not be too short, because the shorter it is the shorter is the time during which the electrodes can cool off and the spark be extinguished. For instance, a condenser which is effective in extinguishing the spark with leads an inch or so in length will fail if the leads are made very short. It is, therefore, recommended that an iron-free coil of moderate self-induction be used in series with the condenser so as to get waves several miles in length. Further, the damping of the oscillation circuit should be as small as possible in order to permit the easy formation of the oscillations. For this reason alone a short wave is

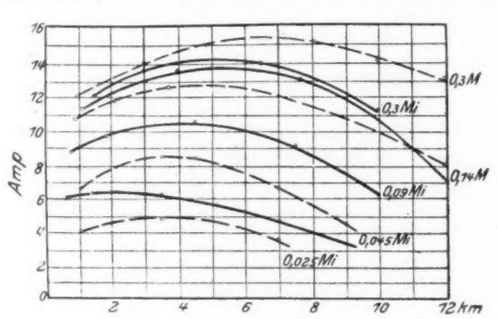


FIG. 2—RELATION BETWEEN WAVE-LENGTH AND CURRENT WHICH CAN BE INTERRUPTED

unfavorable, because with the same resistance it gives a high decrement. The rather complicated phenomena are well illustrated in Fig. 2. The dotted curves refer to silver contacts at 220 volts, the drawn-out curves to platinum contacts at 220 volts. At the right-hand end of each curve the capacity used is given in microfarads. The ordinates give those currents which can be interrupted if self-inductances of such size are used that the wave-lengths

given as abscissas are obtained. The wave-lengths are given in kilometers. Each curve clearly shows a maximum, meaning that for every capacity a certain wave-length can be found for which the current that can be interrupted is a maximum. A simple method based on this principle of extinguishing the arc at the contact is shown in Fig. 3, where *a* is the motor or bank of lamps, etc., to be disconnected; *u* is the switch, *c* is a condenser, *l* the iron-free self-induction coil, and *n* a very high resistance. Switch *u*

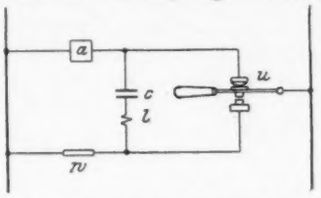


FIG. 3—SPARKLESS INTERRUPTER

is so designed that the whole path through which it can move is only 0.5 mm. If this switch is in the upper position as shown in the illustration, the main circuit is closed and the condenser *c* is charged. To break the circuit the switch *u* is turned down so that it touches the lower contact and the condenser discharges through the high-frequency circuit *clu*. After one-quarter wave-length this high-frequency current reaches a maximum and its direction is opposite to the main current in the arc. The arc is then broken. It is also possible to break the circuit so that no spark is produced at all. For this purpose the high-frequency current is produced shortly before the circuit is broken, the circuit being broken at the instant when the total current is zero. This method is theoretically ideal but practically difficult, as it requires a very exact adjustment. In Fig. 4 if the handle *m* is pressed down on the handle *o*, the high-frequency circuit is closed, but immediately afterward the handle *o* breaks the circuit at contact *s*. The small time difference must be just right and

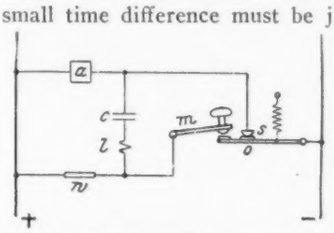


FIG. 4—INTERRUPTER WITH DEVICE FOR EXTINGUISHING THE SPARKS

can be adjusted by the spring which holds the handle *o*. The author finally shows that the same principles are applicable to the extinction of the mercury arc. By combination a mechanical interrupter can also be obtained which is suitable for induction coils and yields up to 1000 interruptions per second.—*Elek. Zeit.*, Oct. 23, 1913.

Motor Speed Regulation.—A note on a recent British patent (No. 7896, 1913) of the Allgemeine Elektricitäts Gesellschaft. A booster with a series-field winding is connected to the driving motor. This winding has a compounding effect during positive boost and a different effect during negative boost. Thus the motor speed is kept constant irrespective of the load.—London *Elec. Eng'ing*, Oct. 30, 1913.

Bohemia and Moravia.—KRASNY.—A paper on the commercial and legal conditions of electricity supply in Bohemia and Moravia. The systematic erection of a complete system of large power plants is advocated, with a combination of municipalities and private parties to invest the required capital.—*Elek. Zeit.*, Oct. 30, 1913.

Electrophysics and Magnetism

Positive Ionization from Heated Platinum.—C. SHEARD AND D. A. WOODBURY.—An account of an experimental investigation on temperature and surface conditions which affect the positive ionization from heated platinum. The chief results are as follows: Two sources capable of producing thermions are present as impurities in platinum. One source of ionization is more easily driven out by heating than the other. After continued heating and when investigated within the proper temperature region, two distinct types of current-time curves are obtained, one showing a decay with time from an initial maximum, the other giving rise to a maximum after two or three minutes' heating followed by the usual decay effects. The thermionic emission from a wire which has lost its power of producing ions may be enhanced and made comparable with the initial effects by (a) heating in a Bunsen flame, (b) heating electrically in hydrogen and (c) cleaning the wire with acid. The proposition is advanced that any change in the surface conditions of a wire or a salt will affect the subsequent ionization effects.—*Phys. Review*, October, 1913.

Recoil Atoms from Thorium C and Actinium C.—A. B. WOOD.—When an alpha particle is expelled from a radioactive atom the remainder of the atom recoils with the same momentum as the ejected alpha particle. The penetrating power of the recoil radiation in the case of the products of radium has been studied in detail by others. In the present paper the ranges of the recoil atoms from actinium C and thorium C are investigated with the object of throwing light on the arrangement of the products in these series. The results are as follows: The range of the recoil atom from actinium C is found to be the same by both the activity and ionization methods; on the other hand, the apparent range of recoil atoms from thorium C is markedly longer by the ionization method. These differences receive a satisfactory explanation by supposing that two distinct groups of recoil atoms are emitted during the transformation of thorium C. The shorter range group is radioactive, the other rayless. The order of disintegration of the thorium series is shown to agree with that suggested by Marsden and Darwin (by an entirely different method), viz., thorium D is the product resulting from the disintegration of thorium C_1 (emitting alpha particles of 4.8 cm range). The product recoiling from thorium C_2 (emitting alpha particles of 8.6 cm range) is probably rayless.—*Philos. Mag.*, October, 1913.

Photoelectric Effect.—K. T. COMPTON AND O. W. RICHARDSON.—There are two lines of experimental investigation which have been followed in the search for the ultimate explanation of the photoelectric effect from metals. Most of the work in this subject has had to do with the velocities of the emitted electrons or the relation of these velocities to the nature of the emitting metal and the frequency and intensity of the incident light. The second line of attack on the photoelectric problem is the investigation of the effect of the intensity of the light, the frequency of the light and the nature of the metal on the numbers of electrons emitted in unit time. Richardson's theory of electric action yields an expression connecting the frequency, nature of the metal and number of electrons emitted in unit time, as well as the expression for the initial kinetic energy. The equation following from this theory was made the subject of an experimental investigation which is described in the present paper. One consequence of the theory is that the rate of photoelectric emission must reach a maximum at some particular frequency, instead of increasing indefinitely with the frequency as was at first supposed. This is confirmed by the experiments. But the sensitiveness-frequency curve shows two maxima instead of one. The experimental results further indicate that the photoelectric sensitiveness is the same function of the frequency for all metals, the difference being that the curve is shifted bodily out to the region of short-wave length for the electronegative metals. —*Philos. Mag.*, October, 1913.

Scattering and Absorption of the Gamma Rays of Radium.—J. A. GRAY.—An account of an experimental in-

vestigation. The chief results obtained are as follows: When gamma rays are scattered there is a change in quality, the scattered rays being less penetrating the greater the angle of scattering. The change is gradual and small when the angle of scattering is small. A similar explanation must be given of the scattering of the X and gamma rays. There is probably very little direct scattering of X and gamma rays. The quality and quantity of the scattered radiation is approximately independent of the nature of the radiator. The softer the type of gamma rays, the greater the percentage scattered per unit mass. A discussion is given of the bearing of the results of absorption experiments, and it is shown why an exponential law signifies heterogeneity of the rays. In the case of X-rays scattering is in most cases so small compared with absorption that an exponential law probably signifies homogeneity.—*Philos. Mag.*, October, 1913.

Units, Measurements and Instruments

Meter.—An announcement of the Reichsanstalt admitting for calibration a direct-current mercury-motor meter and a meter with double counting device built by the Isaria company. The construction of these two meters is described and illustrated.—*Elek. Zeit.*, Oct. 23, 1913.

Telegraphy, Telephony and Signals

Sine-Wave Transmission in Submarine Telegraph Cables.—H. W. Malcolm.—A continuation of his long illustrated serial. In the present instalment the author deals with the attenuation of voltage throughout the cable and with the deformation of battery signals in transmission.—London *Electrician*, Oct. 31, 1913.

Ionization and Oscillations.—E. H. Barton and W. B. Kilby.—An account of an experimental investigation of the effect of ionization of air on electrical oscillations and its bearing on long-distance wireless telegraphy. The authors' results yield some experimental support to the theory of Eccles as to the propagation of electric waves round the curvature of the earth owing to the ionization of the upper atmosphere.—*Philos. Mag.*, October, 1913.

Miscellaneous

Association of Austrian and Hungarian Central Stations.—K. Perlewitz.—An account of the tenth annual convention of the Association of Austrian and Hungarian Central Stations held in Budapest from July 1 to 4, 1913. The association has 111 members, representing 127 central stations with a capital investment of $100,000,000. An Austrian section and a Hungarian section were formed, with separate officers, although the common president is Mr. H. Sauer. Reports on certain legal problems were made by Messrs. Harbich, L. Deutsch, R. Hiecke and Scheinig. Dr. Jellinek lectured on first aid in electrical accidents. He emphasized that the Sylvester method of artificial respiration recommended by the association was the only proper one and that all other methods, like the Schaefer method, should be avoided. Mr. Knoepfel read a paper on switch explosions and Mr. H. Kuhn spoke on fires caused by oil switches in large power plants. A. Kvetensky read a paper on flat tariff and apparatus for limiting the power demand on the premises of the consumers. The next meeting will be held in Cracow.—*Elek. Zeit.*, Oct. 30, 1913.

Presidential Address.—C. Vernier.—His presidential address to the Newcastle Section of the (British) Institution of Electrical Engineers. The author emphasizes that most generating stations in Great Britain are very far from what they ought to be. Some 40 per cent of these generating plants have ratings below 1000 kw and many supply small districts, with high capital charges, poor load-factors and heavy fuel and running costs. Less than 3 per cent of the stations can exceed even a 25 per cent load-factor. Out of 287 stations analyzed, less than 2 per cent have a manufacturing cost of 1 cent per kw-hr. or less. The first step toward improvement must be in the direction of the centralization of all coal-fired generating plants into large power stations supplying bulk energy over very large districts. The most important development of the future will be the electrification of railways, and there will be but one of two alternatives once the electrification of these railways begins in earnest. Either the existing central stations must then be in a position to undertake the supply of all the requirements of the railways or the railway companies will themselves build large generating stations and, at a certain stage of their electrification development, will inevitably seek to supply power customers in bulk. In either case the compelling agency will be that of larger outputs and the better load and diversity factors to be obtained by co-operation. The conditions in Great Britain are compared with those in Germany and especially with those in the United States. The objections to overhead wires and the delay in obtaining the right-of-way for overhead wires in Great Britain is pointed out as well as the discouraging features of the electric-lighting acts.—London *Electrician*, Oct. 31, 1913.

Book Reviews

Sovratensioni negli Impianti Elettrici: Cause, Effeti, Protezioni By Ing. Emilio Piazzoli. Milan, Italy: Ulrico Hoepli. Cloth, 402 pages, 125 illus. Price, $1.10.

An excellent little textbook on the subject of surges, carefully prepared from the electrical engineer's standpoint with reference both to the theory of and practical protection from these objectionable visitors. The book is divided into two sections, dealing respectively with the phenomena of surge voltages and with protectors against surge voltages. The chapters are nine in number and treat of the following subjects: Introduction, over-voltages of internal origin, over-voltages due to lightning, phenomena and damping of over-voltages, systems of protection, preventive protectors, defensive protectors, selection of protectors, installation of protectors. The chapters on the applications of protectors to actual circuits are particularly good. The book will commend itself to transmission engineers having a reading knowledge of Italian who are interested in European lightning-protector practice.

Das Radium und die Radioaktivität. By Dr. M. Centnerszwer. Leipzig and Berlin: B. G. Teubner. 96 pages, 33 illus. Price, 1.25 marks.

A very attractively written little book on radium and its properties. The literary style is unusually interesting in a book on physical science. The writer is not only a physicist but also a historian. The history of the discovery and development of radium in the laboratory of the Curies at Paris is very fascinatingly written. From the physical standpoint the book has the rare and marked merit of attaching units to its symbolic expressions. How often we see in books on physics expressions such as e/m, without being able to find what particular units attach to e and m respectively. After half an hour's search one may find it stated somewhere near the beginning of the book that e is the electric charge in absolute units without any statement as to what particular absolute unit, electric or magnetic, is intended. This common habit is a standing disgrace to our scientific literature. It is so seldom that an author rises to the level of clearly indicating the units he employs that the exception in the book before us should be signalized with thanks and approbation. The book is divided into four sections, dealing respectively with the discovery of radium, the nature of its radiations, other radioactive substances, and applications of radiology. The volume has marked merit in various directions. It contains special information that is hard to find in the general literature of the subject.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Conduit Work in Concrete Construction

In a recent announcement the Chicago Fuse Manufacturing Company remarks that the great increase in the use of reinforced concrete as a building material has brought about some modifications in interior electrical fittings. The difficulty of making alterations after the walls or floors of a building have been poured renders it important that outlets be located exactly and held firmly in position during the pouring process. To meet this need there has been added recently to the "Union" line of conduit fittings made by the company named a new form of extension ring. It has ears on both sides, tapped and fitted with screws to accommodate any standard 4-in. cover or flat ceiling plate. The ring is fastened to the wooden form by nails through the lower ears; the bushings on the conduit are tightened and the cover or plate desired is put on. After the concrete has been poured and has hardened the form is removed and the box is ready to take any cover chosen. The regular depth of this extension ring is 1.625 in., but there is also a "deep ring" of 2.25 in. Greater depth can be easily obtained by building up two or more rings.

OUTLET BOX FOR CONCRETE CONSTRUCTION

New Metal-Molding Fittings

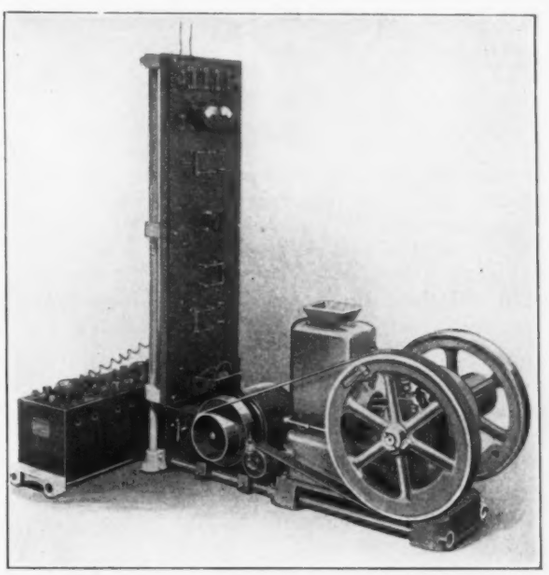
The National Metal Molding Company, Pittsburgh, Pa., has recently developed and placed on the market a number of new and improved fittings, several of which are shown in the accompanying illustrations. Fig. 1 shows a key receptacle of the outlet-box type. Fig. 2 shows a chain-pull receptacle and Fig. 3 a snap switch, both of which are made "dead-end," being designed to be mounted on the molding. In Fig. 4 is shown a fitting used as a coupling where it is necessary to butt two elbows in breaking around a shallow obstruction.

FIGS. 1, 2, 3 AND 4—KEY AND CHAIN RECEPTACLES, SNAP SWITCH AND COUPLING FITTING

The base plates of the fittings applicable directly to the molding have been standardized and are interchangeable. All of these fittings are "dead-end" and can be made continuous by twisting off the scored "blanking ear" on the base plates, thus eliminating the necessity of having contractors and dealers carry separate fittings for "dead-end" and continuous work. The molding is shipped nested with the capping separate. Cap-screws for the various fittings are slightly upset to prevent dropping out.

Small Generating Plant for Farm Use

With the exception of its storage battery, the small electric-lighting plant illustrated herewith is mounted complete on a single sub-base made of steel and iron. Power is obtained from a gasoline engine which is belted to a generator equipped with a combined flywheel and pulley. A belt tightener which takes up automatically all belt stretch is operated by a heavy weight on a short arm. The standards for the switchboard are supported by heavy foot castings, and the panel is of slate, 1.5 in. thick. Two types of switchboard are used, one for full twenty-four-hour service and the other for service where battery may be charged while lights are not burning. The storage battery is mounted on a separate base and may be set in any position with reference to the generating plant, on the floor, on a shelf or in another room.



SMALL ISOLATED GENERATING PLANT FOR FARM USE

After the plant is tested at the factory the battery and generator wires are disconnected from the switchboard and the switchboard is lifted from the pockets in the sub-base and packed separately for shipment. The rest of the machinery is crated as it stands and is ready to run when the crate is taken off. The battery comes fully charged so that energy is available without waiting to charge the battery.

The rating of the gasoline engine ranges from 1 hp to 4 hp. This equipment is built by the Kewanee Water Supply Company, Kewanee, Ill.

One-Piece Bushing

A one-piece bushing that does away with kinks in flexible tubing, allowing straight runs to be made into switch, loom, junction and cabinet boxes and thereby saving tubing and wire, is manufactured by the New Process Specialty Company, Milwaukee, Wis. This "Universal" bushing is tapered at both ends and can be pushed or pulled into place quickly without using any tools and without injuring the tubing or the box. It is made of steel and is brass-plated to prevent rusting. The bushing shown in Fig. 1 is used in switch and loom boxes and all ⅝-in. knockouts, and that in Fig. 2 in cabinets, junction boxes and all ½-in. conduit knockouts.

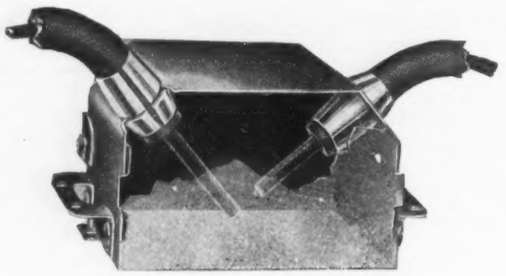


FIG. 1—ONE-PIECE BUSHING FOR ⅝-IN. KNOCKOUTS

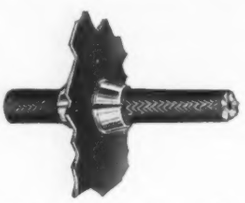
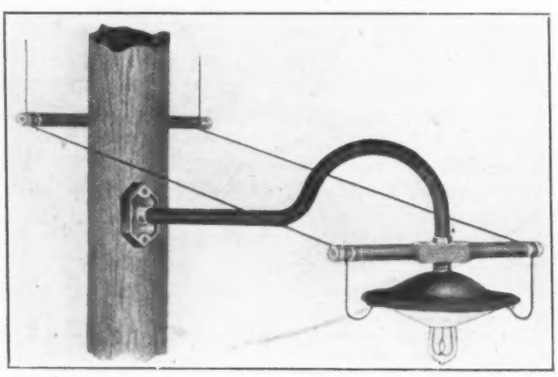


FIG. 2—ONE-PIECE BUSHING FOR ½-IN. KNOCKOUTS

New Reflecting Surface for Outdoor Fixtures

The Line Material Company, South Milwaukee, Wis., has prepared a new substance for the reflecting surfaces of outdoor or street-lighting fixtures which is considered superior to the coating of white japan heretofore used. This new material, which is called "Ky-ce-Lain," is put on the reflector surfaces by means of a secret process. The coating becomes hard and glossy, and its reflecting efficiency is high. Tests have shown that the surface is not affected by bending, although this quality is not necessary in reflector construction.

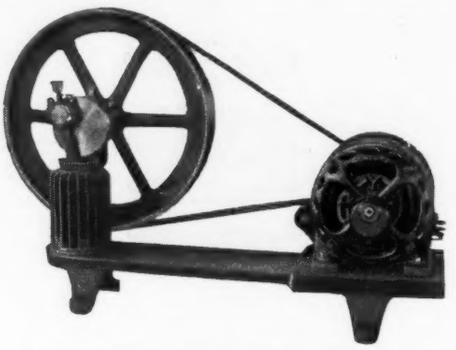


FIXTURE WITH "KY-CE-LAIN" REFLECTING SURFACE

The accompanying illustration shows a fixture manufactured by the Line Material Company furnished with this new reflecting surface. The upper surface is of bluish-black enamel covered with a special weatherproof coating such as used heretofore. The fluted reflectors are porcelain-enameled as before.

Motor-Driven Garage Compressor

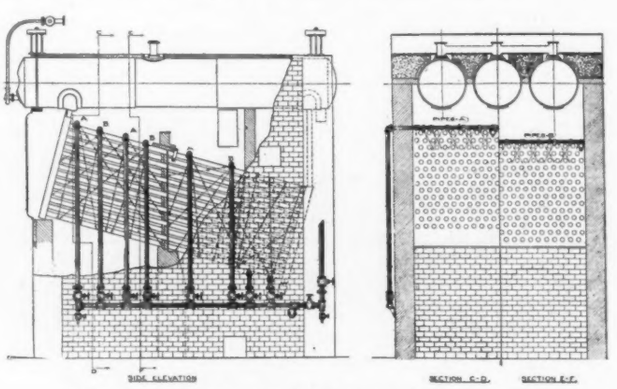
In the illustration herewith is shown a small single-cylinder compressor for garage use. It is mounted on a raised cast-iron sub-base and is belt-driven by a 5-hp motor. The raised sub-base permits of thorough cleaning of the floor around and under the machine and also of removing the valves of the compressor without dismounting the other parts. The apparatus is designed for permanent installation in connection with a storage tank. An automatic starting and stopping switch controls the pumping operation. The compressor is made by the Jacobsen Machine Manufacturing Company, Warren, Pa., and the motor by the Century Electric Company, St. Louis, Mo.



GARAGE COMPRESSOR WITH MOTOR DRIVE

Soot Cleaner

Means for removing soot and ashes by the aid of a cleaner installed as part of the boiler equipment have been developed by the Vulcan Soot Cleaner Company, Chicago, Ill., as shown in the accompanying side elevation and section of a Babcock & Wilcox boiler. This cleaner discharges steam through perforated pipes and nozzles close to the tube surfaces. As a result the tubes in the center are reached as effectively as are those on the sides, and in the case of boilers set in batteries the tubes on the far side are cleaned with the same thoroughness as are those on the alley side.



SIDE ELEVATION OF BOILER WITH SOOT CLEANER

The operation of this Vulcan cleaner is very simple, as it is only necessary to open a set of valves one after another to blow the soot and ashes free from the surface. With this method blowing of the boiler tubes can be done fre-

quently, it being customary to blow them once every watch, which is oftener than is ever done by hand. No doors have to be opened with this kind of blowing, and there is therefore no infiltration of air which would reduce the boiler's efficiency.

In an effort to show that cleaning the boilers by hand is inefficient, a plant was equipped with recording instruments for comparison. Over a period of one month the average leaving temperature of the gases was found to be 517.8 deg., and the average CO_2 content 11.2 per cent. A second similar set of readings covering the same length of time, except that the boilers were blown daily with a Vulcan cleaner, gave an average leaving temperature of 391.8 deg. and a CO_2 average of 11.8 per cent. The CO_2 percentage is given to show that the efficiency of firing in both cases was practically the same. While using the cleaner, therefore, the stack temperature averaged 120 deg. lower, corresponding roughly to a saving of 6 per cent in fuel. Other tests have, it is reported, shown even greater savings with the use of these soot cleaners.

Long-Burning Flame-Arc Lamps

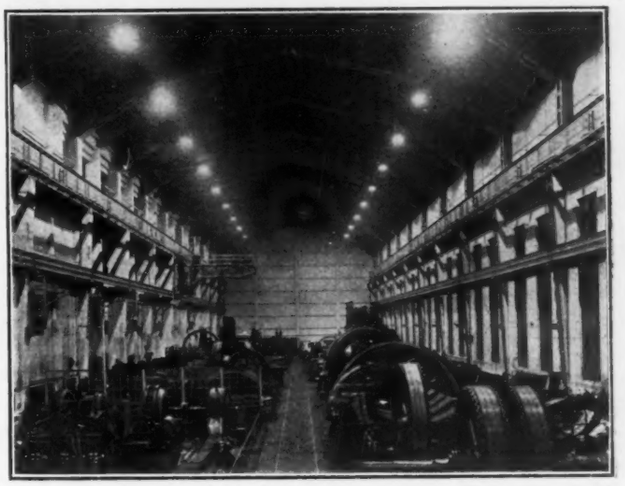
The Allgemeine Elektricitäts Gesellschaft, of Berlin, Germany, has placed on the market a new long-burning

LONG-BURNING FLAME-ARC LAMP

flame-arc lamp for lighting large workshops. The unit, which is illustrated herewith, is known as the Flammeco lamp. It differs from the long-burning flame-arc lamps used for street lighting in the shape of its reflector, by means of which the intensity of the light below the lamp is made much greater. A new type of electrode is used, and it is said that a pair of these electrodes will burn from four to five times as long as a pair of the ordinary carbons now widely used for street lighting. This is an important point in its favor for use in modern factory workshops, where the large traveling cranes, which work continuously day and night, must be interrupted as little as possible by the lowering of the lamps for renewing carbons and cleaning purposes. The lamp is short and compactly built, thus being especially applicable where the suspension height available is limited by the distance between the lower edge of the roof ties and the upper part of the traveling crane.

A high candle-power output is necessary with Flammeco lamps on account of the height of suspension, which may be 65 ft. or more in many erecting shops. The candle-power of the direct-current lamps is sufficient for the purpose with the new electrodes used. The lighting output of the alternating-current lamps has been improved by raising the lamp voltage. These so-called high-voltage lamps operate at pressures ranging from 50 volts to 60 volts, according to the method of connecting them. The alternating-current lamp has a life of 80 hours to 100 hours between trims.

Fig. 2 shows a large workshop lighted by twenty-six alternating-current Flammeco lamps, the height of the arcs being approximately 65 ft. The lamps are hung in two rows, each row being 29.5 ft. from the center line of

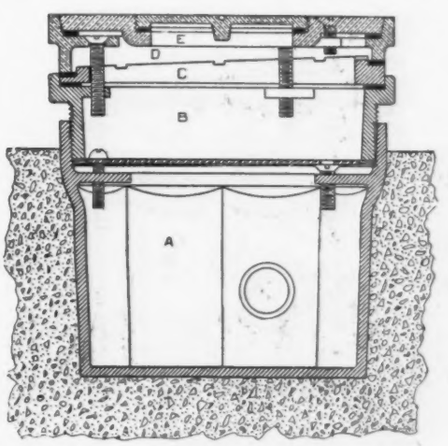


LONG-BURNING FLAME-ARC LAMPS IN LARGE WORKSHOP

the building and the lamps being spaced 32.8 ft. apart. Pairs of lamps are connected in series on a 190-volt supply, an inductive series resistance being used.

Electrical Floor Box

An electrical floor receptacle and junction box for correcting faulty settings has been put on the market by the Lutz-Webster Engineering Company, Inc., Philadelphia, Pa. In the illustration the box *A* is shown carrying the threaded sleeve *B*, by which both circular adjustment through a full circle and vertical adjustment of over 0.5 in. can be obtained. Angular adjustment is made by means of the taper ring *C*, resting in the sleeve *B* and carrying the floor flange *D*. The bottom of the floor flange is provided

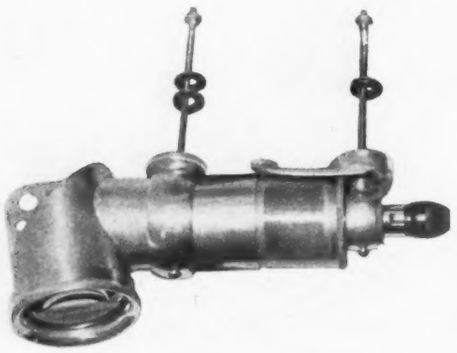


ELECTRICAL FLOOR RECEPTACLE

with a tapered flange corresponding with the taper ring *C*, which for leveling may be freely revolved from the inside with the fingers. The floor flange *D* is fastened by three screws to lugs on *B*, binding the taper ring and gaskets between them and forming water-tight joints. The box, threaded sleeve and taper rings are made of galvanized cast iron. Other parts are made of brass.

Glareless Automobile Lamp

The Roffy-Grace Corporation, 1926 Broadway, New York, is putting on the market an electric lamp for automobiles designed to produce a strong light and at the same time eliminate the glare common with so many automobile head-lamps. The light from the filament is passed through condensing lenses to a mirror and reflected back



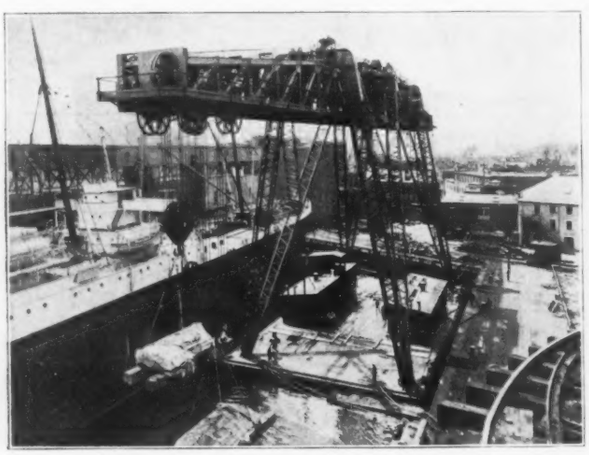
ELECTRIC AUTOMOBILE LAMP

finally through a focusing lens which corrects all chromatic and spherical aberration, producing a white light on the roadway. The lamp is a small tubular device usually fastened to the radiator in an upright position. It is so focused that the rays of light follow the driver's line of vision.

Electrically Operated Pontoon Cranes

Two 150-ton pontoon cranes have recently been built by the Wellman-Seaver-Morgan Company for the United States Navy Department. One of these large electrically driven hoists is to be placed in the Boston harbor and the other in Pearl harbor, Honolulu. Both will be used for transferring freight to lighters and for erecting or removing turrets, guns, boilers and other machinery or apparatus used on battleships.

In order to test the accuracy of the control equipment in landing a load, a heavy weight was lowered by the crane



PONTOON CRANE IN BOSTON HARBOR

to strike a block laid on top of an empty oil can. It was found possible to stop the load without injuring the oil can or deforming it. In order further to test this point, the weight was suspended about 2 in. above the block and then lowered to see how close it could be brought to that object without touching it. The distance was found to be 0.0625 in.

The controllers for both cranes are of the magnetic type and were furnished by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Bracketless Semi-Indirect Wall Fixtures

The H. W. Johns-Manville Company, New York, has put out a new bracketless wall fixture for semi-indirect

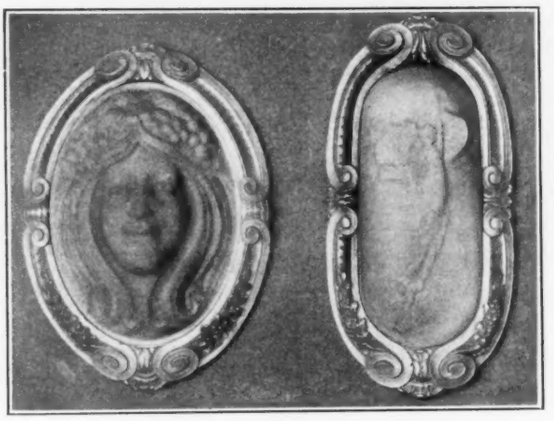


FIG. 1—SEMI-INDIRECT-LIGHTING UNITS

lighting which is designed particularly to harmonize with surrounding objects. The bracket has been eliminated because the large amount of glassware in such a semi-indirect unit, if hung at a distance from the wall, would give the fixture an incongruous appearance. In Fig. 1 are shown two types of these new fixtures, each consisting of a socket equipment attached to the outlet box, a frame and the glassware.

The glassware mentioned comprises the molded glass cover and the silvered rippled-glass reflector which directs the light through the molded cover at the desired angle, thus eliminating spots directly under and above the frame. The molded piece may be tinted to suit the interior coloring.

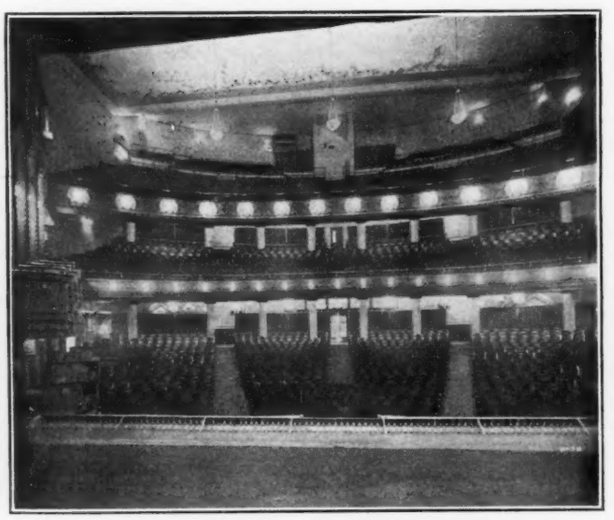


FIG. 2—BRACKETLESS WALL FIXTURES IN A THEATER

The fixture is well adapted to low rooms, such as are found in yachts or bungalows where an extension bracket tends to exaggerate the lowness of the ceiling and to give a crowded effect to the room. Fig. 2 shows nineteen of these units installed in a theater, the glassware harmonizing with the interior decorations in both design and color, without a perceptible decrease in efficiency.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

H. M. Byllesby on the Outlook.—Henry M. Byllesby, president of H. M. Byllesby & Company, recently returned to Chicago from a brief visit to England. In relation to industrial conditions, he said that while there is doubtless financial depression in the United States at the present time, it is his opinion that normal prosperity and easier money will prevail within a reasonable period. He voiced a feeling of confidence in the ultimate fair treatment of utilities and corporations throughout the United States by the various regulatory commissions having jurisdiction over them.

Wireless Towers on the Isthmus.—According to the *Canal Record*, the official organ of the Isthmian Canal Commission, the Penn Bridge Company, of Beaver Falls, Pa., which has the contract from the Navy Department for the fabrication and erection of the three 600-ft. towers for the proposed Darien radio station at Caimito, has let a subcontract to the Central American Construction Company, of Colon, to do the work of erection. Forces of the quartermaster's department of the Isthmian Canal Commission are engaged in the preliminary work of erecting the foundation piers of concrete for the towers.

Special Cable Block Being Furnished.—A special form of porcelain cable block, fitted with the Fahnestock quick connection spring clips, is being made for the Western Union Telegraph Company by the Fahnestock Electric Company, of 129 Patchen Avenue, Brooklyn. N. Y. The blocks are hollow and are fitted with clips for about a dozen leads. They are intended for use in locations where, for purposes of testing or other reasons, frequent changes in the cable connections are necessary. Aside from this work the company is experiencing the slight falling off in business usually encountered at this season.

Belgian Agents for American Manufacturers of Engineering Equipment.—The Association Technique, of 88 Rue de la Montagne, Brussels, Belgium, has been organized recently for the purpose of representing in Belgium and other parts of Europe the American manufacturers of machinery, appliances and materials for use in connection with railroads, public utilities, mines and other similar service. This concern will be prepared to represent firms manufacturing tramway track materials and allied lines. The association has very high personal recommendation and will be glad to hear directly from any American manufacturer in the above fields. Correspondence may be carried on in English.

Pioneer Electric Locomotives in Alaska.—What are said to be the first electric locomotives ever used in Alaska were placed in service within the past few months for mining operations by the Alaska Treadwell Gold Mining Company at Treadwell. The mine is an immense low-grade-ore property equipped with two mills, having an equipment of 540 stamps, power plants, foundry, cyanide plant, machine shop, sawmill and central hoisting and crushing plant, practically all of which are either operated by electric motor or being equipped for electric drive. The two initial 6-ton, 500-volt, direct-current locomotives were manufactured by the General Electric Company and are of the standard outside-frame type, in which the side frames are placed outside of the wheels.

Motorcycle Accessories Shown.—In view of the probability that the cycle car is soon to enjoy a larger popularity, it is of interest to note the progress that has been made toward adapting electric lighting and accessory equipment to the special demands on the smaller types of self-propelled vehicles. At the National Motorcycle, Bicycle and Accessory Show in Chicago, during the past week, there were shown a number of electrical equipments for lighting, ignition and horn operation on motorcycles. The Rex Battery Company, of Chicago, showed a lighting system consisting of a 6-volt generator with self-contained regulator and battery cut-out and a 6-volt storage battery, with switch, fixtures, head-lamp and tail-lamp. In operation the battery furnishes energy for the lamps when the motorcycle is standing still or when running at low speed. As the speed increases the generator furnishes an increasing part of the required energy until at 15 miles per hour the dynamo furnishes enough electricity to light both lamps.

Drawback Allowances Made Under the New Tariff Law.—In many cases, particularly in the machinery and allied industries, products made in this country contain parts or accessories of foreign manufacture, which have to be imported for this service. A good many of these products enjoy a large foreign sale and in order to avoid the injustice of making the builders pay duty on the parts which are imported for assembly and then sent out to the foreign market, there is provision in the tariff law for the payment by the government of drawback allowances on such parts at the time of export. Among the concerns which have recently taken advantage of this allowance are the Remy Electric Company, of Anderson, Ind., which uses imported ball bearings in its electric starting, lighting and ignition apparatus for automobiles, and the Timken-Detroit Axle Company, of Lansing, Mich., which uses imported worm gearing as part of its axle-drive equipment.

Gas-Engine-Driven Generators for an Industrial Plant.—Barnhart Brothers & Spindler, a branch of the American Type Founders' Company, are building a large and modern plant in Chicago, into which they expect to move shortly after the first of the year. In their present factory motor drive is used throughout, and its success there has been sufficiently apparent to warrant its use in their new factory. Here, however, there will be installed also a complete isolated power plant, which is to be furnished by the Alberger Gas Engine Company, of Buffalo, N. Y. The generating equipment to be installed will include one 75-kw and one 150-kw Alberger gas-engine-driven set and one 75-kw electric welding set. An electrically operated coal-handling system is to be installed also. The gas engines used in this installation will be duplicates in many respects and arranged so that parts are to a large extent interchangeable. They will have a substantial overload capacity in addition to the ratings mentioned. The Alberger Gas Engine Company reports the sale of gas engines of 50-hp rating and above, aggregating 1415 hp.

Edison Storage Battery Company's New Factory Almost Completed.—The new plant of the Edison Storage Battery Company at Orange, N. J., is practically completed and awaits only the installation of machinery in order to start making this product on the enlarged scale made necessary by the rapid development of storage-battery applications in electric trucks and pleasure cars, street-railway cars, train lighting, wireless telegraphy, railway, police and fire signaling, farm lighting and other similar uses. Owing to the facts that a modification of the present alkaline nickel-iron battery will shortly be put on the market by this company and that pending the arrival of new machinery more than 100 of its employees were recently laid off, temporarily, a rumor was spread to the effect that a large part of the producing force had been dropped and that the new type of battery was to displace the present type. R. A. Bachman, vice-president and general manager of the company, has issued a denial to this rumor, stating that by the latter part of December all new machinery will be installed, the present machinery rearranged in the new plant and 2000 new employees added to the production force. He says that the present type of battery is to be put out right along and announces that Lord & Taylor, in providing for the electric

delivery wagon fleet for their new store, have followed the lead of R. H. Macy & Company, Hearn, Loeser, Abraham & Straus and other large department stores in New York, by standardizing on Edison batteries.

Chicago Seeking Private Capital for Subway Construction.—The City Council of Chicago, Ill., has authorized an advertisement for proposals to construct a comprehensive system of passenger subways within the city limits that will be operated independently of existing surface and elevated transportation lines and that will ultimately be municipally owned, through the amortization of the construction debt out of earnings. This ordinance specifies certain routes approximating 57 miles in length, with about 135 miles of single track, for which the construction estimates approximate $96,000,000 for subway construction and $34,000,000 for equipment. In case any bid on this work is found acceptable, it is planned to incorporate it in detail in a second ordinance and submit this, together with two alternative plans, involving municipal construction and furnishing temporary relief in a limited section of the city, for a referendum vote at the municipal elections in April, 1914.

York Manufacturing Company's Sales Increase.—In the Nov. 8 issue of the *Electrical World* the statement was made that the sales of refrigerating machines by the York Manufacturing Company during October had fallen off about 50 per cent from the September figures. Information comes from that concern to the effect that this decrease was in the capacity of the machines installed during the period stated and that sales showed an increase of about the same proportion during that period. The peculiar relation existing between the company's sales and its installations is explained in the following abstract from a recent communication: "Our installations are heaviest during the summer months when sales are the lightest. Beginning with October, installations drop off and sales begin to increase. As a matter of fact, our sales for the month of October showed an increase over September of 50 per cent in the number of machines and an increase of over 125 per cent in the tonnage represented by these machines."

Electric Truck Manufacture in Receiver's Hands.—Creditors of the Atlantic Vehicle Company, of New York, recently filed an involuntary petition in bankruptcy against that company, and A. P. Osborn, of 14 Wall Street, New York, and H. L. Davisson, of the Edison Storage Battery Company, Orange, N. J., have been appointed receivers. This action was taken owing to the inability of the company to secure sufficient working capital to warrant its continuance in business at the present time. The liabilities of the company approximate $132,000, and it has nominal assets of about $110,000. The company has a number of partly built trucks on hand, and these the receivers propose to complete. They also propose to liquidate part of the assets of the company by the sale of Atlantic trucks, a number of which are now completed and ready for delivery. It is hoped that a reorganization of this company may be effected and that its business will be continued in a short time. The Atlantic electric truck has made an excellent trade record, and its users number some of the important breweries and express companies and other users of commercial vehicles.

Electricity in Large Demand in the Pittsburgh Coal Fields.—A considerable increase in the demand for electric service is being experienced in the coal region around Pittsburgh, Pa. For the week ended Nov. 1 the gain in motor-service business of the West Penn Traction & Water Power Company and its subsidiaries was 798 hp, and in addition to this there has been noticed a gain in the lighting and traction demand. Among the coal-mining companies which are finding electricity useful in their operations are the Pittsburgh Coal Company, which has 450 hp in motors at its Midland No. 1 mine and is planning for the electrification of a number of its other properties; the Pittsburgh-Buffalo Coal Company, which is said to anticipate the installation of 1500 hp in motors shortly; the Logansport Coal Company, with 150 hp, and the Meadowlands Coal Company, which plans to add 450 hp for operation of fans and hoists. In the new plant of the Latrobe Electric Steel Company the energy for operating the electric furnace is furnished by the West Penn company. In order to take care of this large amount of new business the latter company is now installing a new generator at its central station near Connellsville, Pa., and is rushing the work on its Cheat River hydroelectric development.

Electricity Used in Zinc Mines.—The Interstate Light & Power Company, one of the subsidiaries of the Consumers' Power Company, serves a large part of the southwestern Wisconsin zinc-mining fields with electric power. Since H. M. Byllesby & Company took over this property, late in 1910, the connected load has increased 81 per cent, and the energy output has increased to more than 225,000 kw-hr. per week. A large part of the electrical output is consumed in the zinc mines and reduction plants, the hilly character of the country and the isolated location of many of the mines rendering central-station electric power highly desirable to the zinc-mining industry. Prior to acquiring the property Byllesby & Company had acted in the capacity of consulting engineers for the previous owners and had designed and constructed a modern steam power station of 2750 kw rating. The growth of the business made it necessary in 1911 nearly to double the station rating by the addition of a 2000-kw turbine unit. There are now 103 miles of transmission lines serving the district, which includes the cities of Galena, Ill., and Platteville, Shullsburg, Darlington, Cuba City, Benton and Hazel Green, Wis. The population of these communities shows only a small growth, but recent prospecting has developed a number of new and large ore bodies and the outlook for additional business from this source is good.

Electrical Equipment of Gasoline Automobiles.—The three papers under this head delivered before the American Institute of Electrical Engineers in New York on Nov. 14 are significant in more than their actual contents. While many people are absolutely sure of the superiority of the electric vehicle over the gasoline car, there is generally speaking no such conviction. The gasoline automobile has many advocates, both for commercial and for pleasure use, who take no stock at all in electric drive. However, it is very evident that the use of electrical equipment for starting and lighting and the operation of automobile accessories has come to stay and has standing with the strongest advocates of gasoline-engine drive. And the applications of electricity on gasoline-driven machines are growing continually, some of the latest being electrically operated horns, electric gear shifters and electromagnetic brakes and clutches. There seems to be a wide difference of opinion as to the proper means for supplying this service, but trial will eliminate the inadequate and impracticable in a comparatively short time with so many investigators in the field. The question that seems very pertinent, however, in view of these tendencies, is whether or not it is economical to install this auxiliary electrical equipment and still continue to use the gasoline-engine drive, when the whole operation, including drive and accessories, can be handled with greater reliability and simplicity by electricity alone.

NEW YORK METAL MARKET PRICES

	Nov. 11 Bid.	Nov. 11 Asked.	Nov. 18 Bid.	Nov. 18 Asked.
Copper:				
Standard, spot*	.....	.....	.....	.....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	68 7 6		69 10 0	
Prime Lake	16.00	to 16.25	.....	.....
Electrolytic	15.75	.....	15.25	to 15.37½
Casting	15.50	.....	15.00	to 15.12½
Copper wire base	17.00	.....	16.37½	to 16.50
Lead	4.35		4.35	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.50		7.50	
Spelter, spot	5.30	to 5.40	5.30	to 5.35
Tin, spot	39.15	to 39.35	40.05	to 40.50
Aluminum:				
Prompt delivery	19.50	to 19.75	19.37½	to 19.62½
Future	19.25	to 19.50	19.00	to 19.50

*OLD METALS

Heavy copper and wire	14.50	14.00
Brass, heavy	9.50	9.00
Brass, light	8.25	8.25
Lead, heavy	4.20	4.20
Zinc, scrap	4.37½	4.37½

*COPPER EXPORTS

Total tons to Nov. 18 16,985

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Bond Issue by the Hornell Electric Company.—Authorization has been secured by the Hornell (N. Y.) Electric Company, from the Public Service Commission, for the execution of a mortgage to the Colonial Trust Company to secure $400,000 of first and refunding 5 per cent bonds. It is planned to issue $150,000 of these bonds shortly, exchanging $85,000 of them for the first mortgage bonds of the company and using the proceeds from the sale of the others to discharge current liabilities.

People's Gas Company Increases Capital Stock.—By a vote of the stockholders the People's Gas Light & Coke Company, Chicago, has increased its capital stock from $35,000,000 to $50,000,000. The present stockholders have the privilege of purchasing new stock in an amount equal to 10 per cent of their present holdings. The stockholders also authorized a new refunding mortgage. This is an open mortgage and will take care of all underlying liens and future needs of the company for construction and betterments. No amount is specialized in the mortgage. Samuel Insull is the president of the board of directors of the People's Gas Light & Coke Company.

Scope of Middle West Utilities Company.—The Middle West Utilities Company, of Chicago, now controls public-utility properties in eleven states. The principal subsidiary companies are the Twin State Gas & Electric Company, operating in Maine, New Hampshire, Vermont and New York; Kentucky Utilities Company, Marquette County Gas & Electric Company and Constantine Hydraulic Company, Michigan; Interstate Public Service Company, Indiana; United Gas & Electric Company and other properties in and near New Albany, Ind.; Illinois Northern Utilities Company; Tri-County Light & Power Company, Illinois; Central Illinois Utilities Company; Central Illinois Public Service Company; Missouri Gas & Electric Service Company, and the Public Service Company of Oklahoma.

Western Union Telegraph Award Upheld.—On Nov. 10 the United States Supreme Court handed down a decision denying the petition of the American Telephone & Telegraph Company for a new trial in the suit brought against it by the Western Union Telegraph Company in 1883. The suit was begun by the American Speaking Telephone Company to ascertain the amount owing to it by the Bell system under an agreement dating back to 1879 and concerning telephone royalties. In 1909 an award was made by E. W. Burdett, of $2,579,914 and 20,087 shares of stock of Bell subsidiaries. This judgment has been affirmed successively by the lower federal courts and the United States Circuit Court of Appeals, and this decision of the Supreme Court practically closes the case. Assuming a par value for the stock involved, the award amounts to approximately $4,500,000.

Mount Whitney Power & Electric Company Improvements.—Among the improvements in progress on the properties of the Mount Whitney Power & Electric Company are the building of a new reservoir with a capacity of 150,000,000 cu. ft., the enlargement of the Lindsay substation, the construction of a fifth hydroelectric plant on the Kaweah River, and the building of an addition to the auxiliary steam plant. The present capacity of the company's generating stations, 13,000 hp, is large enough to handle its business for some time, but an effort is being made to keep a good margin for reserve. The first mortgage bonds of the company can only be issued, for the purpose of carrying on extensions and improvements, after the money for such work has actually been paid out, and because of this limitation the company was forced early in the present year to issue some one-year notes. As the work progresses the bonds can be sold and the proceeds used for refunding these notes.

Maine Utilities Combined.—Announcement has been made by E. W. Clark & Company, of Philadelphia, Pa., that the Cumberland County Power & Light Company, of Portland, Maine, has obtained control of the York Light & Heat Company, which does an extensive electric light and power business in Biddeford, Saco, Kennebunk, Wells, York Harbor and other coast towns of that state. The first-mentioned utility owns and controls three hydroelectric stations, having a rating which totals 18,750 hp, and six steam generating plants, aggregating 13,800 hp in rating. It has recently obtained a five-year contract for the supplying of electric energy for light in the cities of Portland and South Portland, Maine. As soon as the proposed transmission lines can be completed it is stated to be the intention of the Cumberland County Power & Light Company to serve the territory formerly covered by the York Light & Heat Company from its own water-power stations, holding the steam stations of the latter concern in reserve.

United Properties Company Reorganization Planned.—A plan for the refinancing of the dozen or more public utility properties controlled by the United Properties Company of California has been placed before the trustees by R. G. Hanford and W. H. Tevis, vice-presidents and directors of the company. This plan will call for the expenditure of about $7,000,000, as the company's obligations include $2,500,000 due N. W. Halsey & Company on an issue of 6 per cent short-term notes which matured in June, 1913, and $1,150,000 of 6 per cent collateral trust notes, which matured in August of this year. In addition it is planned to pay $1,000,000 to F. M. Smith for his interest in the company, as well as to pay all the debts of the subsidiary companies. There is also a call for $750,000 with which to complete the projected improvements of the United Light & Power Company. The source from which these funds are to be obtained has not been made public and is being withheld until after action on the proposed plan has been taken.

Portland Railway, Light & Power Company Matters.—As a result of competitive bidding, the Portland (Ore.) Railway, Light & Power Company has secured the contract for lighting the streets of Portland for three years, beginning Jan. 1, 1914. With the 10,000-hp turbo-generator set recently installed, the company has a total generating capacity of 90,000 hp. which supplies a large part of the energy used in the electric railway, light and power lines in Portland, as well as in a number of the adjacent towns of Washington and Oregon. On Nov. 7 the City Commission of Portland passed an ordinance requiring the company to give six rides for 25 cents on its street-car lines. This ordinance is expected to go into effect thirty days after its passage. The directors of the company have recently declared a quarterly dividend of $1 per share, payable Dec. 1. This represents a reduction of 25 cents from the previous quarterly declaration. Following the completion of the extension work now in progress, the company is expected to show an increase in net earnings.

Allis-Chalmers Manufacturing Company Report.—The report of the Allis-Chalmers Manufacturing Company for the year Oct. 1, 1912, to Sept. 30, 1913, issued recently, covers the period from the former date to April 15, 1913, when the receivership terminated, and the subsequent period, following the reorganization, up to the latter date. The fiscal year of the company corresponds to the calendar year, and hence this report is not an annual one. Since the Bullock Electric Manufacturing Company is controlled and owned largely by the Allis-Chalmers Manufacturing Company, this report includes the balance sheet of that concern, together with that of the latter company. The total liabilities of the latter company as of Sept. 30, 1913, were $44,774,012, and during the year ended on that date the total sales amounted to $11,660,359, on which there was realized a net profit of $601,310. The former company's liabilities as of Sept. 30, 1913, were $4,859,652, and during the year covered by the report its total sales came to $2,597,474 and a net profit of $80,636 was obtained. On Oct. 1, 1913, the unfilled orders on hand were, for the Allis-Chalmers company $3,579,931 and for the Bullock company $658,575. According to the report, the volume of business handled between April 16 and Aug. 1, 1913, was very satisfactory, but since the latter date the volume of new business has fallen off in connection with what is thought to be a general slackening of business throughout the country. The manufacturing properties of both of the above-mentioned companies are stated to be in excellent condition, and the several departments in each company are well organized and working in thorough co-operation. With a normal volume of business it is expected that the Allis-Chalmers Manufacturing Company will show substantial net earnings.

Business Notes

F. W. Rose, consulting engineer, has moved from the Palace Building to 470-475 Auditorium Building, Minneapolis, Minn.

The Carbo Steel Post Company announces that on and after Dec. 1 its main sales offices will be in the Rand-McNally Building, Chicago, Ill.

The Union Metal Manufacturing Company, formerly of 30 Church Street, has moved its New York office, in charge of W. L. Fairchild, to 110 West Fortieth Street.

Clark Electric & Manufacturing Company.—Charles J. Dempwolf has severed his connection with the Clark Electric & Manufacturing Company, New York City, and is now connected with the General Baking Company, 30 Church Street, New York.

The J. & H. Electric Company, Inc., of 155 Clifford Street, Providence, R. I., is doing an electric repair and exchange business in motors and generators. Its officers are C. E. Harmon, president; W. M. Hodges, vice-president, and L. E. Whitehead, secretary and treasurer.

The Goulds Manufacturing Company, of Seneca Falls, N. Y., has appointed C. L. Newcomb, Jr., as its Western representative to succeed G. B. Turner. Mr. Newcomb's headquarters will be at 12 Chamber of Commerce, Denver, Col., and he will look after the company's interests in the Rocky Mountain and Northwestern territories.

The National Electrical Specialty Company, of Toledo, Ohio, has appointed H. E. Gifford, Jr., sales manager, with headquarters in Chicago. Mr. Gifford resigned as Western representative of the L. S. Brach Supply Company to accept this position, and he will now be largely interested in the marketing of the "Vac-M" lightning arresters, manufactured by the Ohio firm.

The Star Advertising Company, of Springfield, Ill., after completing a contract with the Illinois Traction Company which will require several months, is planning to take up the manufacture of electrical novelties and advertising devices. The headquarters of the company are in the Gaiety Theater Building, Springfield, Ill., and its president and general manager is H. J. Spurway.

New Industrial Companies

The Missouri Electrical Company, of St. Louis, Mo., has been chartered with a capital stock of $2000 to do a general electrical business. The incorporators are Lester J. Harris, G. L. Camp and Arthur C. Eckert.

The General Storage Battery Company, of St. Louis, Mo., has been incorporated by Joseph Desloge, Firmin and Louis Desloge. The company is capitalized at $2000 and proposes to manufacture and deal in storage batteries.

The Automatic Display Company, of Chicago, Ill., has been incorporated by Charles R. Casler, George M. Bagley and Irma Labes. The company is capitalized at $100,000 and proposes to sell mechanical and electrical apparatus.

The Nonpareil Lock Company, of Chicago, Ill., has been incorporated with a capital stock of $40,000 to manufacture locks, hardware and electrical specialties. The incorporators are Matthew Borwick, C. F. Dusman and A. B. Cameron.

The Metropolitan Appliance Company, of Chicago, Ill., has been incorporated with a capital stock of $1,000 by George W. Levin, W. F. Cumming and W. J. Maher. The company proposes to manufacture and sell electrical and mechanical devices.

The International Electric Pump Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $250,000 and the incorporators are F. D. Buck, G. W. Dillman and B. M. Grawl, of Wilmington, Del.

The Electric Contractors Company, of New York, N. Y., has been chartered with a capital stock of $150,000 for the purpose of doing a general electrical contracting business. The incorporators are C. Metzer, of Brooklyn; R. E. Habel and A. S. Henry, of New York, N. Y.

Trade Publications

Storage Battery Locomotives.—"Storage Battery Locomotives for Mine and Industrial Haulage" is the title of a booklet of the Electric Storage Battery Company describing the application of its product to service of that nature.

Wiring Devices.—A large post card is being mailed by the Metallic Seamless Tube Company, Ltd., Meta House, Corporation Street, Birmingham, England, reminding contractors of its "metallic" accessories, such as ceiling rosettes, cut-outs, wall plugs, wire, fittings, brackets and other material.

Lighting the Home.—An attractive booklet recently issued by Harvey Hubbell, Inc., Bridgeport, Conn., tells in an entertaining manner about "A Delightful Way to Light Your Home." The illustrations are very pleasing and are a fitting accompaniment to the text. Reference is made to the beauty, efficiency and convenience of Hubbell pull sockets on lamps all over the home.

Porcelain Fixtures.—A leaflet containing on one side illustrations of its white porcelain lighting fixtures and on the other side prices, sizes and descriptions, has been issued by Rush Brothers Company, 136 West Lake Street, Chicago, Ill. These fixtures, which are made of solid porcelain, are especially suitable for rooms with white woodwork, for sanitary restaurants, hospitals, schools and the like.

Motors.—The compensated type of polyphase motor is illustrated and fully described in Advance Bulletin No. 160, recently published by the Bell Electric Motor Company, Garwood, N. J. It is claimed for these motors that they will start their full load with about twice full-load current without extra starter, that they are automatic and foolproof and have a high power-factor and a high efficiency.

Motor Drive in Textile Mills.—Electrically driven pickers are the subject of a bulletin issued by the Westinghouse Electric & Manufacturing Company. Illustrations and descriptions are given of four methods of drive used for pickers. Detail views of the motors adapted to this service and the method of mounting them and a number of graphic meter curves illustrating the load on this type of machine are shown.

Diesel Engines.—A pamphlet issued recently by the American Krupp System, Diesel Engine Company, tells about the oil-engined ships in operation and projected by the East Asiatic Company, Ltd., and gives information on the formation of the American company to handle the rights of the German manufacturers in this country. Mr. J. L. Bogert is the engineer of the company, with headquarters at 165 Broadway, New York.

Telephone Receivers.—The "Other Ear" receiver, a device said to intensify the receiving qualities of any telephone, is made the subject of a leaflet recently issued by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. This receiver is especially adapted for use in noisy shops and factories and for long-distance work. The company's 896 compact-type magneto telephone is illustrated and described in another leaflet.

Isolated Low-Voltage Electric Plants.—Electric energy for lighting, heating and motor service in places remote from a central supply station is discussed in a pamphlet recently issued by the Kewanee Water Supply Company, Kewanee, Ill. The advantages of isolated plants installed with Kewanee gasoline engines are clearly described. Information regarding the different parts of the outfit and full details are given as to the cost of plants of various ratings.

Engineering Data.—In a forty-four-page booklet with the title "Data for Electrical Engineers," the Metropolitan Engineering Company, Forty-second Street Building, New York, has assembled much useful information. A chapter on tampering leads logically to a reference to the complete line of protective devices manufactured by the company, of which a few illustrations and brief descriptions are given. Watt-hour-meter data, definitions of electrical units, a conduit and wire diagram, stranded conductors, and incandescent lamp information—a portion of the contents—suggest the character of the data presented. A good index would have increased the usefulness of the pamphlet.

Personal Mention

Mr. Arthur Brown has been made manager for the Central Illinois Public Service Company at Edinburg, Ill.

Mr. A. L. Utz has succeeded Mr. M. C. Hunter as superintendent of the municipal electric-lighting plant at St. Joseph, Mo.

Dr. Alexander Graham Bell has been awarded the gold medal of the Royal Society of England in recognition of his inventions, notably that of the telephone.

Mr. E. S. Fletcher, manager of the Temple property of the Texas Power & Light Company, has been appointed district superintendent with headquarters at Temple.

Mr. A. R. Norman has been appointed manager of the Eugene (Ore.) branch of the Oregon Power Company. Mr. Norman was formerly manager of a group of utilities in Illinois.

Mr. L. J. Hannah, manager of the new-business department of the Louisville (Ky.) Gas & Electric Company, has resigned to become connected with a local mercantile firm which, it is understood, will be headed by Col. Robert E. Hughes, former president of the Kentucky Electric Company.

Mr. Herbert L. Harries has resigned his position as assistant general manager of the Louisville Gas & Electric Company to become connected with another Byllesby property. Mr. Harries was assistant to the president of the Louisville Lighting Company until its consolidation with the other gas and electric companies of the city, when he was made assistant general manager.

Mr. Philip S. Dodd, who has been manager of the *Electrical Review,* director of publicity of the National Electric Lamp Association, secretary of the Commercial Section of the National Electric Light Association, and one of the organizers and recently secretary-treasurer of the Society for Electrical Development, has allied himself with the Tucker Agency, Inc., advertising agent, of New York City.

Mr. Allan G. Armstrong has resigned as general auditor for W. S. Barstow & Company, Inc., New York City, managers for the General Gas & Electric Company and the Eastern Power & Light Corporation, to head an auditing company which will specialize in accounting for public-utility corporations. Mr. Armstrong has been connected with electric railways, gas and electric-light corporations for the last fifteen years.

Mr. W. R. W. Griffin, former manager of the Tri-State Railway & Electric Company, East Liverpool, Ohio, has been appointed general manager of the following properties, with offices in the Potters Savings & Loan Building, East Liverpool: Beaver County Light Company, Steubenville; Midland Electric Light & Power Company; Wellsburg Electric Light, Heat & Power Company; Wellsburg & Weirton Railway, and the Hancock County Electric Company.

Mr. Edward N. Hurley, president of the Hurley Machine Company, Chicago, is chairman of a committee of the Illinois Manufacturers' Association which is arranging a "foreign-trade cruise." A party of members of the association will sail from New York on Feb. 7 for Buenos Aires and will visit other South American trade centers. Mr. Hurley was recently appointed by Governor Dunne a delegate from Illinois to the National Conservation Congress in Washington during the present week.

Mr. C. Peter Clark has been appointed chief of the rate and tariff bureau of the Massachusetts Public Service Commission, with headquarters at Boston. Mr. Clark is a son of the late Charles P. Clark, former president of the New York, New Haven & Hartford Railroad, and is a native of Jamaica Plain, Mass. He has had a varied railroad experience, including service as general freight agent of the Old Colony Railroad and Fall River Line, general manager of the New York & New England Railroad and superintendent of the eastern division of the New York, New Haven & Hartford Railroad. Ten years ago he was appointed second vice-president and general manager of the Buffalo & Susquehanna Railroad and has since made his headquarters in Buffalo.

Mr. Hugh McCloskey has resigned as president of the New Orleans (La.) Railway & Light Company and has been elected chairman of the board of directors of the company and president of the American Cities Company, the common stock of which has been acquired by the United Gas & Electric Corporation. He will assume his new office Dec. 1. Mr. McCloskey first became identified with electric work in New Orleans in 1893 as a member of the board of directors of one of the subsidiary companies of the New Orleans Railway & Light Company. On Feb. 22, 1908, he was elected chairman of the board, and the following month he succeeded Mr. E. C. Foster as president of the company. The company under Mr. McCloskey's direction has made important improvements in the railway, electric-lighting and gas departments. Mr. McCloskey's connection with the New Orleans dock board was fraught with much service as the long lines of wharves and great steel sheds in that city show. He received recently the *Picayune's* loving cup for his public-spirited efforts in giving the city its wharves and sheds. Mr. McCloskey, besides being so prominently identified with the electric and railway development in the South, is first vice-president of the D. H. Holmes department store, vice-president of the Hibernia Bank & Trust Company and the Hibernia National Bank, and vice-president of the Hibernia Insurance Company. He was the founder of McCloskey Brothers, one of the largest wholesale grocery and produce firms in the South.

Mr. A. O. Kuehmsted, who was elected president of the Electrical Credit Association of Chicago at the annual meeting on Nov. 14, is the vice-president of the Gregory Electric Company of Chicago and has been active in electrical business circles in that city for a number of years. Mr. Kuehmsted was serving as vice-president of the Credit Association when promoted to the presidency. He has been connected with the Gregory Electric Company since 1895 and handles the business end of the concern. He is a native of Oshkosh, Wis., and was born in 1863. He went to school and obtained his early business training in Oshkosh and removed to Chicago in 1899 after he had been affiliated with the Gregory company for several years. Mr. Kuehmsted is an alert, active, intelligent man keenly interested in all forms of progress and advancement. He is a member of the Chicago Association of Commerce, the Illinois Manufacturers' Association, the Chicago Athletic Association, Electric Club of Chicago, Hinsdale Golf Club, LaGrange Country Club and other social and business organizations. His home is in Hinsdale, Ill., a suburb of Chicago. He has read papers before several business organizations and has contributed to the trade press. Last winter he was a delegate from the Illinois Manufacturers' Association to the convention of the National Association of Commerce at Washington. His straightforward, downright methods have made him popular among electrical men in Chicago.

A. O. KUEHMSTED

Obituary

Charles D. Robbins, president of the Robbins Electric Company, of Pittsburgh, Pa., died Nov. 12 at his home in Pittsburgh, aged seventy-nine. Mr. Robbins was born in Philadelphia and went to Pittsburgh twenty years ago. One son, Mr. Harris Robbins, survives him.

Charles W. Amory, who died Nov. 5 at his home in Boston, Mass., was a director in many corporations, including the American Bell Telephone Company, the American Telephone & Telegraph Company, the Western Telephone & Telegraph Company, the Western Electric Company and the Edison Electric Illuminating Company of Boston.

Construction

New England

BIDDEFORD, ME.—The Cumberland County Pwr. & Lt. Co., of Portland, has secured control of the York Pwr. Co., which furnishes electricity in Biddeford, Saco, Kennebunk, Wells, York Harbor and other points along the York County coast. When the necessary transmission lines can be completed the company proposes to supply these places with energy from its hydroelectric plants, using the steam-power plant of the York Pwr. Co. for reserve only.

ELLSWORTH, MAINE.—The Bangor Ry. & El. Co., of Ellsworth, expects to purchase within the next two months three sets of aluminum lightning arresters. Edward M. Graham is assistant to president.

GREENVILLE, N. H.—The Greenville El. Ltg. Co. expects to purchase within the next three months a 3-kw to 5-kw marine set or a 3-kw to 5-kw turbine.

PLAISTOW, N. H.—The Plaistow El. Lt. & Pwr. Co. expects to purchase 15 transformers and 60 meters; also rectifiers, arc lamps and incandescent lamps (small amount). The company purchases energy from the Haverhill El. Co., of Haverhill, Mass. E. H. Landman is president.

SOUTH RYEGATE, VT.—The Ryegate Lt. & Pwr. Co., of South Ryegate, expects to purchase within the next ten months auxiliary equipment, including coal and ash-handling machinery, exciters, pumps, condensers, etc. M. F. Sargeant is president.

ATTLEBORO, MASS.—The Attleboro Steam & El. Co. has applied to the State Board of Gas and Electric Light Commissioners for permission to issue $80,000 in additional capital stock, the proceeds to be used to pay for additions and improvements now being made. Edgar Tregoning is manager.

CHELSEA, MASS.—New bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 29 for an underground electric transmission line from the navy yard, Boston, Mass., to the United States Naval Hospital, Chelsea, Mass., a distance of about 1 mile, according to Specification No. 2000.

SOUTH MANCHESTER, CONN.—Plans are being considered for the installation of an ornamental street-lighting system in the business section of the town. The present plans provide for 132 lamp standards carrying three-lamp clusters, to be maintained by underground wires. The South Manchester Lt., Pwr. & Tramway Co. has agreed to install the system, provided the town will enter into an agreement for a period of five years. The cost of the system is estimated at $5,000.

Middle Atlantic

EAST ROCHESTER, N. Y.—The Despatch Ht., Lt. & Pwr. Co. expects to purchase a small supply of electrical appliances and suppplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. For particulars address the company at 34 Clinton Avenue, Rochester. Royal Parkinson is general manager.

NEW YORK, N. Y.—The Public Service Commission has awarded the first construction contract for a section of the Interborough Seventh Avenue subway line to the Degnon Contracting Co., of New York, for $2,185,063. The contract was for Section 3, which extends under Varick Street, and the Seventh Avenue extension from Beach Street to Commerce Street.

ASHLAND, PA.—Notice has been filed that application will be made to Governor Tener for a charter for the Ashland El. Co. by Charles Elwood Hanna, Thomas Evans, Charles S. McGirr, J. A. McKee and William J. Montgomery. The company proposes to furnish electricity for lamps, heat and motors. Frederick M. Leonard, 119 South Fourth Street, Philadelphia, is solicitor.

ASPINWALL, PA.—Bids will be received by the borough of Aspinwall, addressed to S. R. Chase, borough clerk, 230 First Street, Aspinwall, until Nov. 24 for the following apparatus: Approximately 245 1-2-3-4 point brackets, 1000 insulators, 3750 lb. No. 6 copper wire, 180 fixtures complete for tungsten street-lighting system. Further information may be obtained from H. C. Lea, superintendent of public works.

GIRARD, PA.—Notice has been given that application will be made to Governor Tener for a charter for the Schuylkill El. Co. by Thomas Evans, Charles Elwood Hanna, Charles S. McGirr, J. A. McKee and William J. Montgomery. The company proposes to furnish electricity for lamps, heat and motors. Frederick M. Leonard, 119 South Fourth Street, Philadelphia, is solicitor.

NEWTOWN, PA.—Bids will be received by the Hanover Township School District until Nov. 28 for furnishing and installing gas and electric-light fixtures in the high school building at Newtown, in accordance with drawings and specifications prepared by Austin L. Reilly, architect, 58 Bennett Building, Wilkes-Barre, copies of which may be obtained upon application to the architect.

PITCAIRN, PA.—The Borough Council expects to purchase within the next six months street-lighting fixtures for 60 series tungsten street lamps. J. H. Travis is borough clerk.

SCRANTON, PA.—Plans are being prepared by the Watts Engineering Co. for the installation of an electric-light and power plant to be installed at the works of the Eureka Pwr. Co., of Scranton.

HARRISON, N. J.—The Hyatt Roller Bearing Co. is building a new power station for its manufacturing plant on Somerset Street.

JERSEY CITY, N. J.—Bids will be received by the Board of Education (committee on new school No. 24) until Dec. 4 for the construction of a school building, to be located on Virginia Avenue, near West Side Avenue, including complete electrical work, heating and ventilating apparatus. John T. Rowland, 98 Sip Avenue, is supervising architect.

PATERSON, N. J.—The Society for the Establishment of Useful Manufactures is contemplating the erection of a large steam generating plant in connection with the hydroelectric station it is now building at Passaic Falls, to be used as auxiliary to same. John W. Cooke, of Passaic, is hydraulic engineer.

TRENTON, N. J.—Contract has been awarded by the Pub. Ser. El. Co. for the construction of a new substation on Olden Avenue to serve the East Trenton district, to cost about $12,000.

BALTIMORE, MD.—Bids will be received at the office of the lighthouse inspector, Baltimore, Md., until Dec. 1, for furnishing storage batteries and charging panel. Blank proposals and particulars may be obtained by addressing the lighthouse inspector, Baltimore, Md.

BEAVER HOLE, W. VA.—The West Virginia Devel. Co. is reported to be contemplating a hydroelectric power development on the Cheat River at Beaver Hole, located about 13 miles from the Pennsylvania State line. The present plans provide for the construction of a dam about 1200 ft. long and 100 ft. high, power house to be built in and forming part of the proposed dam. It is estimated that 54,000 hp can be developed which will be distributed in West Virginia and southwestern Pennsylvania. No definite plans have been made for beginning construction work. F. W. Schneidenhelm, 503 Bank for Savings Building, Pittsburgh, Pa., is chief engineer. Beaver Hole has not a post office.

COEBURN, VA.—The Coeburn Lt. & Pwr. Co. expects to purchase within the next three months one ½-kw, two 1-kw and one 5-kw transformer and about 35 poles, six 5-amp meters and 2000 ft. No. 10 copper wire and 5000 ft. No. 14 copper wire. Claude H. Cox is manager.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Nov. 29 for furnishing one common-battery lamp line, three-position switchboard, (total capacity, 600 common-battery lines, 40 magneto lines and 45 cord circuits), completely wired, but only equipped for 400 common-battery lines, 38 magneto lines, and 30 cord circuits, under Proposal No. 681. Further information may be obtained upon application to Major W. L. Clark, disbursing clerk.

North Central

BAY VIEW, MICH.—The Bay View Camp Ground Association, electric-light department, expects to connect 50 to 75 cottages next season and will purchase meters for same, and probably about 25,000 ft. of wire; also necessary pins, insulators, etc. Electricity for operating the system is purchased from the Petosky municipal electric plant. Luther C. Mason is superintendent.

BLISSFIELD, MICH.—The taxpayers voted against a bond issue of $16,000 for repairs and extensions to the municipal electric-light plant, which probably means the abandonment of municipal ownership of the plant. The Citizens' Lt. & Pwr. Co., of Adrian, has offered to purchase the local plant and furnish electricity for lamps and motors, giving a 24-hour service.

GAYLORD, MICH.—The Saginaw Wood Products Co., it is reported, will remove its machinery to this city and later will install equipment for a power plant. Work will begin at once on the erection of a temporary building for power plant. R. K. Carr is general manager.

PORT HURON, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 8 for a conduit and wiring system, extension of gas-piping system and lighting fixtures at the United States court house and post office in Port Huron. For details see proposal columns.

QUINCY, MICH.—The Light and Water Works Department expects to install within the next 60 days one 10-in. by 18-in. by 10-in. compound engine directly connected to a 50-kw, two-phase, 60-cycle, 1200-volt generator and a four-panel switchboard. George J. Mickle is superintendent.

CINCINNATI, OHIO.—Bids will be received at the office of the Board of Hospital Commissioners, Burnett Avenue, Cincinnati, Ohio, until Dec. 9 for furnishing material and labor required for the erection of the new Tuberculosis Sanitorium and additions and alterations to porches on present ward building No. 2, in Lick Run, Hamilton County, in accordance with plans and specifications prepared for same and which are on file in the office of Tietig & Lee, architects, 716 Lyric Building, Cincinnati. Proposals will be received separate on each branch or any number of branches, or for the work complete, including all branches. Nos. 1 to 14 include excavation, masonry, general construction, etc.; (15) elevator work; (16) electrical work; (17) plumbing and gas fitting. Bids will also be received at the same time and place for labor and materials required in the heating and engineering work in the new Tuberculosis Sanitorium in Lick Run, in accordance with plans and specifications prepared for same and which are on file in the office of Walter G. Franz, consulting engineer, Union Trust Building, Cincinnati. Proposals will be received separately on each branch or any number

of branches, or on the work in aggregate, as follows: (1) boilers, stokers, smoke connection and coal cars, tracks and scales; (2) power piping, steam transmission lines and heating systems; (3) covering and insulation; (4) temperature regulation; (5) electric transmission system; (6) refrigerating plant; (7) laundry equipment. Plans and specifications are also on file in the office of the Board of Hospital Commissioners. C. R. Holmes is permanent chairman and E. L. Kennedy is clerk.

CLEVELAND, OHIO.—An ordinance permitting the Cleveland El. Illg. Co. to extend its steam-heating system was passed at the recent election.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary to the director of public service, No. 204 City Hall, Cleveland, until Dec. 4 for boiler-feed pumps for the municipal electric-light plant. W. J. Springborn is director of public service and W. H. Kirby is secretary.

CLEVELAND, OHIO.—The city of Cleveland expects to erect within the next six months three substations and to install 50,000 ft. of underground cable in connection with the municipal electric-light plant; also to purchase transformers of various sizes (about 18 of 500 kva and 50 or 75 of various sizes), steam turbine exciter set, two 150-hp induction motors, one 100-hp and one 75-hp induction motor, three 5000-kw turbo-generators (contract awarded to the Allis-Chalmers Co.); main switching equipment (Westinghouse Co.); six 1000-hp boilers (Stirling and Babcock & Wilcox); three boiler-feed pumps, one 11-panel distribution switchboard, two substation switchboards (sizes not yet determined); also oil switches, protective devices, etc. (not yet decided upon); lightning arresters, poles, insulators, meters, wire, etc., amount not yet determined. Within the next eight months the city will probably purchase tub transformers, probably 10 or 15, and arc lamps, probably 500 or more. F. W. Ballard, Jr., is constructing engineer.

HURON, OHIO.—Within the next two months the Board of Trustees expects to purchase one 110-kva and one 60-kva, 60-cycle, three-phase, 2200-volt generator, with switchboard complete, and panel for street-lighting; also either series direct-current arc-lamps and rectifier, or complete series tungsten equipment. J. C. Britton is superintendent of the municipal electric-light plant.

LANCASTER, OHIO.—The proposal to issue bonds to the amount of $135,000 for the installation of a municipal electric-light plant was defeated at the election held Nov 4.

LIMA, OHIO.—Bids will be received by the Board of County Commissioners of Allen County, Court House, Lima, until Dec. 8 for the necessary wiring at the Allen County Infirmary to distribute electricity from the switchboard to maintain 130 lamps at the main building and barn. Bids will also be received at the same time and place for the installation of an electric generating plant at the County Infirmary. The equipment is to include a prime mover, generator and storage battery, with all necessary accessories, to deliver 10 kw at the switchboard, which shall be included in the proposed installation at 110 volts, the storage battery to be capable of sustaining the voltage for 50 lamps of 16 cp for eight hours; also one 2-hp motor and 1-hp motor. H. J. Lawlor is clerk of board.

MARIETTA, OHIO.—The City Council has passed an ordinance providing for an issue of $2,825 in bonds for improvements to the municipal electric-lighting system. It is proposed to replace the present arc lamps, of which there are 218, with tungsten lamps, using 350 lamps. A portion of these will be placed in Norwood and Fairview Heights. In the business district 300-watt lamps will be used, which have already been purchased; 250-watt lamps will be used in the residence section.

MARYSVILLE, OHIO.—The Marysville Lt. & Wtr. Co. expects to complete its transmission lines to Milford Center within the next 30 days. Mayne Mackan is superintendent.

MINERAL CITY, OHIO.—The Board of Trustees of the municipal electric-light plant expects to purchase some vacuum cleaners. C. K. Limmer is superintendent.

MOUNT BLANCHARD, OHIO.—A franchise has been granted to Bert L. Marvin, of Findlay, to construct and operate an electric-light plant in Mount Blanchard. Mr. Marvin was also given a contract for street-lighting for a period of 10 years.

NELSONVILLE, OHIO.—The Hocking Pwr. Co., of Nelsonville, expects to erect within the next two months 3 miles of three-phase transmission lines. T. C. Hulbert is superintendent.

NEW WILMINGTON, OHIO.—Plans are being considered for extension of the street railway of the Mahoning & Shenango Valley R. R. & Lt. Co. from New Castle to New Wilmington.

NORWALK, OHIO.—We are informed that preliminary steps only have been taken toward the installation of a municipal electric-light plant. H. Whitford Jones & Co., of Cleveland, Ohio, have been engaged to take charge of the matter. A. W. Carpenter is director of public service.

NORWOOD, OHIO.—The power station of the municipal electric-light plant and water-works system was damaged by fire recently, causing a loss of about $50,000.

OAK HARBOR, OHIO.—Arrangements are being made for the installation of a municipal electric-light plant, bids for construction of which will be asked for about Jan. 1, 1914. The plans provide for a 125-hp steam generating plant and about 7 miles of distribution lines. George Champe, Nasby Building, Toledo, is engineer. Louis L. Cartersen is city clerk.

SALINEVILLE, OHIO.—Within the next two months the Salineville El. Lt., Ht. & Pwr. Co. expects to purchase a 150-kw to 180-kw, single-phase, 60-cycle, 1100-2200-volt (primary 7200 volts) alternator. P. S. Hart is superintendent.

HARRODSBURG, KY.—The town of Harrodsburg expects to purchase one boiler with stokers, one 150-kw direct-current generator and about 20,000 lb. of wire (from 0000 to 000000) within the next three months. Albert Riley is superintendent.

HENDERSON, KY.—Within the next 30 days the managers of the municipal electric-light plant expects to install a 400-hp Stirling boiler, Babcock & Wilcox chain grates, a 750-kw Westinghouse turbine, a Westinghouse surface condenser and an electrically driven river pumping plant for city waterworks; also to erect a 225-ft. by 11-ft. Heine radial brick stack. All equipment has been purchased and delivered. L. P. Hite is superintendent.

HORSE CAVE, KY.—The installation of an electric-light plant in Horse Cave is under consideration. P. T. Vaughn, it is reported, is interested in the project.

LOUISVILLE, KY.—The Louisville Gas & El. Co. has made arrangements to supply the Louisville & Southern Indiana Trac. Co., which operates a suburban service out of Louisville to New Albany and Jeffersonville, Ind., with energy to operate its cars. This will require a service of about 500 kw until March 1, 1914, and 1000 kw thereafter.

EVANSVILLE, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 8 for a conduit and wiring system in the United States Marine Hospital, Evansville, Ind. For details see proposals columns.

ALEDO, ILL.—The Tri-County Lt. & Pwr. Co. has asked the City Council for permission to change its system from direct to alternating current, and that the city cause the dissolution of an injunction which it secured restraining it from bringing energy from outside sources and from changing the system from direct to alternating current.

CLINTON, ILL.—The property of the Clinton Gas & El. Co. is reported to have been purchased by the McKinley syndicate, of Champaign.

ELGIN, ILL.—New lamps, extensions of and rearrangements of the present lighting systems in Lord's and Wing Parks will be made next spring.

GALESBURG, ILL.—A resolution has been introduced in the City Council providing that investigations be made to secure an estimate of the equipment needed to enable the municipal electric plant to supply electricity for commercial purposes. The plant at present furnishes street-lighting service only. Alderman Charles Miller is interested in the project.

GALVA, ILL.—The Galva El. Lt. Co., recently incorporated with a capital stock of $150,000, has purchased electric plants in four towns and will build a large central power plant in Galva to furnish electricity in the towns of Altoona, Oneida, Galva, Lafayette and Cambridge, Ill. Equipment to be purchased by the company will include two boilers in batteries of one each, 250 hp and 300 hp respectively; rocking or self-dumping grates; one 250-kva to 300-kva, 2300-volt generating unit, with turbine or belted to Corliss engine, with switchboard equipment; transformers (standard voltages and sizes); eight transformers for substations, 2300 volts to 13,200 volts, 25 kva to 75 kva, with arresters, switches, fuses, supplying about 30 miles of three-phase pole lines, B. & S. No. 6 bare, hard-drawn wires; poles, cross-arms, insulators, anchors, meters (probably Westinghouse), and incandescent lamps. E. L. Brown is president and E. O. Brown is manager of the company.

HARVEL, ILL.—The Village Board has awarded a contract to the Southern Illinois Lt. & Pwr. Co. for lighting the streets of the village for a period of two years.

JACKSONVILLE, ILL.—At a recent meeting of the directors of the Chamber of Commerce the report of Prof. Bryant, of the University of Illinois, for the installation of a municipal electric plant was submitted. Two proposals were submitted as follows: (A) For a plant with sufficient output to maintain 180 arc lamps (450 watts), 90 kw; 184 Mazda lamps of 100 cp, 18.4 kw; 544 Mazda lamps of 60 cp, 40.8 kw, making a total of 149.2 kw; (B) 664 Mazda lamps of 100 cp. 66.4 kw; 136 Mazda lamps of 60 cp, 10.2 kw, making a total of 76.6 kw. The commercial load of the city, including that required for pumping, has a maximum of nearly 500 kw. The cost of a complete distribution system and power plant for street, residence and commercial lighting is estimated at $200,000; street-lighting system only and power plant to maintain same will cost about $60,000. The Jacksonville Ry. & Lt. Co. has submitted a new proposal for street-lighting, offering to install and maintain 60 three-lamp posts, 75 one-lamp posts and 545 one-lamp swing brackets, with an all-night service, for the sum of $15,000 per year. Unless the company gives the city better terms the Chamber of Commerce will favor the proposed bond issue.

KIRKLAND, ILL.—The Village Board has awarded the Illinois Northern Utilities Co., of Chicago, Ill., a contract for street-lighting and for furnishing electricity to operate the pumps at the water-works station for a period of ten years.

MOLINE, ILL.—The City Commission has approved the plan of Commissioner E. L. Eastman to install 111 new tungsten lamps at the street corners in the city.

MOLINE, ILL.—Improvements will be made to the lighting system of the southeast and southwest bluffs. The present arc lamps will be

replaced with 110 tungsten lamps without additional cost to the city. It is proposed to replace the arc lamps throughout the residence sections with tungsten lamps, the present plans providing for 200 additional lamps. Arc lamps will be used in the business section.

STEWARD, ILL.—The Steward El. Lt. & Wtr. Co. expects within the next few months to erect an 8000-gal. storage tank for fuel oil. The company has recently installed a new 25-hp Fairbanks & Morse engine and a 25-kw generator. C. T. Beitel is secretary and treasurer.

STRASBURG, ILL.—The Central Illinois Public Ser. Co., of Mattoon, is negotiating with the village officials with a view of installing an electrical distributing system in Strasburg.

VENICE, ILL.—Extensive improvements will be made to the local plant of the Madison County Lt. & Pwr. Co. (a subsidiary of the Illinois Trac. System), involving an expenditure of about $75,000, a large portion of which will be used for the installation of an additional water-pumping plant. New equipment will also be installed in the power station.

CORNELL, WIS.—At an election held Nov. 8 the proposal to construct a municipal electric-light plant was carried. L. G. Arnold, of Eau Claire, Wis., is consulting engineer. J. E. McArthur is village clerk.

NEW LISBON, WIS.—The Electric Light and Water Works Commission expects to purchase within the next six months a transformer, one meter for testing purposes; also to purchase electrical appliances and supplies, but as yet cannot give any definite amount. Theodore Wahl is superintendent.

WITTENBERG, WIS.—The Wittenberg El. Co. expects to purchase within the next six months one 23-in. waterwheel to operate under a 20-ft. head, one waterwheel governor for above wheel, 50 lightning arresters, 15,000 ft. of wire and wiring supplies; also within the next eight months it expects to purchase a number of small transformers for small motors and also some small motors, ranging from 1 hp to 5 hp. E. L. Debot is president and manager.

BREWSTER, MINN.—At an election held recently the proposal to install an electric-light system was carried. The City Council is authorized to proceed with the work and erect a transmission line from the city of Worthington to Brewster, the cost not to exceed $5,000.

SHAKOPEE, MINN.—The distribution lines of the municipal electric-light plant have recently been changed from the two-phase to the three-phase system. Within the next two months the town will purchase a 400-gal., 100-lb. pressure centrifugal pump, directly connected, and will also complete the installation of a series tungsten lamp street-lighting system. T. E. Harris is superintendent.

SPRING VALLEY, MINN.—The Southern Minnesota Pwr. Co., of Spring Valley, expects to erect 10 miles of 13,000-volt transmission line to Grand Meadow, a distance of 10 miles, and to change its system from direct to alternating current. Within the next eight months the company expects to purchase a small supply of electrical appliances and supplies, including small motors, vacuum cleaners, heating apparatus, etc. The company is now installing 20 ornamental lamp-posts (carrying five-lamp clusters) on Broadway. M. C. Brown is superintendent.

WINONA, MINN.—The Wisconsin Ry., Lt. & Pwr. Co. is contemplating the construction of a double transmission line between Hatfield and Winona erected on steel towers. Clement C. Smith, of Milwaukee, Wis., is president of the company.

APPLINGTON, IA.—C. J. Long, of Webster City, Ia., is engineer in charge of the construction of the proposed municipal electric-light plant, work on which is already under way. Henry Busse is clerk.

CEDAR RAPIDS, IA.—The City Council has passed a resolution to call an election on Dec. 15 to submit to the voters the proposal to issue $125,000 in bonds for the construction of a steel and concrete dam across the Cedar River at the site of the present dam. The contract which the city has with the Iowa Ry. & Lt. Co. provides that the city shall build the dam and lease fifty-nine-sixty-fourths of the water-power to the company at a yearly rental of 10 per cent of the cost of the dam. The contract is for a period of ten years.

EARLVILLE, IA.—A special election will be held on Dec. 9 to vote on the proposal to issue bonds for the construction of a municipal electric-light plant. William Hunt is clerk.

ELDORA, IA.—The Iowa River Lt. & Pwr. Co., of Eldora, expects to purchase about April 1, 1914, one waterwheel. The company is constantly purchasing electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners and washing machines. J. C. Lundy is manager.

KEOKUK, IA.—The Keokuk El. Co. has increased its capital stock from $650,000 to $900,000.

SHEFFIELD, IA.—The Sheffield El. Lt. & Pwr. Co. has purchased one 135-kva, 2300-volt, two-phase, 720 r.p.m. Triumph generator (belted type) and expects soon to purchase 12 lamp standards for five-lamp clusters and armored cable for same. The company also would like to receive prices on one 1¼-in. and one 1½-in. centrifugal pump which will prime itself at 12 ft. or 13 ft., directly connected to a single-phase motor, for use as a small fire engine. C. C. Carhart is owner and manager.

MARSHFIELD, MO.—The Marshfield El. Co. expects to purchase a pump and motor for well for ice plant; also 50 fans and 100 flatirons. John E. Hosmer is secretary and manager.

SALEM, MO.—The Salem Lt. & Pwr. Co. expects to purchase within the next two months one 20-kw to 30-kw generator and steam engine to relieve the 90-kw machine after midnight; also 20 5-amp meters. C. A. Wallof is general manager.

ST. LOUIS, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 20 for a new plumbing system, conduit and wiring system and interior lighting fixtures in the United States custom house at St. Louis, Mo. Drawings and specifications may be obtained from the custodian of building or at the above office. O. Wenderoth is supervising architect.

SWEET SPRINGS, MO.—The town of Sweet Springs expects to purchase one 75-kw generator and one or two engines for the municipal electric-light plant within the next 30 days.

BLAIR, NEB.—At an election to be held Nov. 28 the proposition to issue bonds for the installation of a municipal electric-light plant will be submitted to the voters. Plans and estimates have been prepared by the Towle Engineering Co., of Omaha, Neb. S. W. Chambers is city clerk.

BRUNING, NEB.—The village of Bruning has engaged Grant & Fulton, engineers, of Lincoln, to prepare plans and supervise the construction of an electric-light plant and water-works system, contracts for which will be let about Jan. 15, 1914. The cost of the work is estimated at $16,000. J. J. Breckert is clerk.

CHADRON, NEB.—The Chadron El. Lt. & Power Co. expects to purchase within the next six months some electrical supplies. Kass & Klingaman are proprietors of the electric plant.

ARMA, KAN.—Bids will be called for in about 30 days for the construction of an electric-light plant and water-works system, to cost approximately $30,000. Albert C. Moore, of Joplin, Mo., is engineer.

CAWKER CITY, KAN.—The City Council will soon submit the proposal to issue $7,000 in bonds for the purchase of the local electric-light system to the voters.

DOUGLAS, KAN.—Plans are being prepared by Albert C. Moore, engineer, of Joplin, Mo., for the proposed water-works system, for which bonds have been voted. The equipment of the proposed plant will incluue oil engines, generator, motor-driven pumping machinery, filtration plant, water mains, a 50,000-gal. tank and tower. Bids for the above will probably be called for the latter part of December. C. A. Ogg is city clerk.

LIBERAL, KAN.—The Liberal Lt., Ice & Pwr. Co. expects to purchase within the next three months a carload of 25-ft. and 30-ft. (butt-treated) poles. H. W. Magruder is president and manager.

Southern States

WENDELL, N. C.—The City Council has purchased a site on Little River and is receiving proposals from various electric companies for the construction of plant and will close contracts within the next 10 days. As yet no engineer has been engaged. J. Ackley Wall is city clerk.

WINSTON-SALEM, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 16 for the extension (including plumbing, gas piping, heating apparatus, electric conduits and wiring and approaches) of the United States post office at Winston-Salem. Drawings and specifications may be obtained at the above office or from the office of the custodian, at Winston-Salem. O. Wenderoth is supervising architect.

BRADENTOWN, FLA.—The Manatee El. Co., of Bradentown, expects to purchase within the next two months about 50 meters and 10 transformers, and within the next three months it expects to purchase 100 series incandescent lamps. The company may also install a new circulating-water set. P. R. Chambers is local manager.

PASSAGRILLE, FLA.—The proposal to issue $11,000 in bonds for municipal improvements, to include the construction of an electric-light plant, completion of water-works system and improvements to street and seawall, will be submitted to the voters.

HURTSBORO, ALA.—The city of Hurtsboro is reported to have awarded the contract for the proposed municipal electric-light plant and water-works system to the J. B. McCrary Co., of Atlanta, Ga. Bonds to the amount of $10,000 were recently voted for the work.

GLOSTER, MISS.—The Woodmere Springs Lt. & Wtr. Co., it is reported, contemplates the construction of a hydroelectric-power plant. John L. McGehie, of Gloster, is interested in the project.

JONESBORO, ARK.—Plans have been prepared for the construction of a new power house (80 ft. by 120 ft.) for the State Agricultural College at Jonesboro, to replace the one recently destroyed by fire. Two 100-hp return-flue, bricked-in boilers, one 25-kw, 110-220-volt direct-current generator and an engine directly connected (Corliss engine preferred) will be required for the plant. Other machinery for the plant will not be selected for some time. For further information address V. C. Kays, principal, Jonesboro.

RAYNE, LA.—The managers of the municipal electric-light plant expect to purchase within the next three months one 60-hp crude oil engine. E. J. Bertrand is superintendent.

ALTUS, OKLA.—The managers of the municipal electric-light plant are contemplating the erection of a transmission line to Olustee, a distance of 8 miles, to furnish electrical service in that town; also to furnish elec-

tricity to the farmers along the line for irrigation purposes. W. G. Smith is superintendent of the municipal plant.

CHANDLER, OKLA.—The Chandler El. Co. expects to purchase within the next 30 days one 40-kw or 50-kw, 60-cycle or 133-cycle, 2400-volt generator for arc-lamp circuit. The company has recently purchased a 65-hp Foos gas engine. D. M. Bangs is secretary.

MUSKOGEE, OKLA.—The Sequoyah Club is planning to install a small power plant at Buffington, about 44 miles east of Muskogee, to furnish electricity for lighting club house and grounds. The equipment will include a small undershot waterwheel and generator of sufficient output to maintain 200 or 300 lamps and switchboard for same; 200 or 300 incandescent lamps, and electrical supplies for above. E. M. Graham, of Muskogee, is engineer. Joseph Dickmann, of Muskogee, has contract for construction of dam. Homer Needles is president of the Sequoyah Club.

BALLINGER, TEX.—Citizens of Ballinger and surrounding territory are considering a proposal to build a large irrigation and power dam on the Colorado River to cost about $4,000,000. The proposed dam would store sufficient water to irrigate 300,000 acres and develop considerable power. If the proposal now under consideration falls through an attempt will be made to have the federal government take up the matter.

ELKHART, TEX.—C. H. Martin, manager of the Texas Pwr. & Lt. Co., of Palestine, has submitted a proposal to the Town Council for furnishing electrical service here. It is proposed to erect a transmission line from Palestine to Elkhart, a distance of 12 miles.

MARFA, TEX.—The Marfa El. Lt. & Ice Co. has recently installed two new three-phase generators and one Fairbanks, Morse & Co. oil engine.

Pacific States

LEAVENWORTH, WASH.—The Tumwater Lt. & Wtr. Co., of Leavenworth, has been granted a 25-year franchise to furnish electrical and telephone service here.

SEATTLE, WASH.—Plans, it is reported, have been announced by the Skagit Pwr. Co., controlled by the Stone & Webster Corpn., of Boston, Mass., for the development of the water-power sites recently granted by Secretary Houston of the Department of the Interior on the Skagit and Cascade Rivers. On the Skagit River a concrete diverting dam 50 ft. high, a tunnel conduit 3.7 miles in length and a power house will be built. On the Cascade River the water will be diverted by a concrete dam 20 ft. in height and 200 ft. long. A flume and tunnel will carry the water a distance of 6 miles to the proposed power plant. The present plans provide for equipment to generate 50,000 hp at the two plants. Electricity generated at the plants will be transmitted to Seattle, Tacoma and adjacent cities.

SPOKANE, WASH.—Final contracts, it is reported, will soon be awarded by the Chicago, Milwaukee & Puget Sound R.R. Co. for equipping the railroad for electrical operation from Harlowton, Mont., to Avery, Idaho, a distance of 440 miles. The cost of the work is estimated at $7,000,000. The railroad will also be equipped from Spokane, Wash., to Coeur d'Alene, Idaho, a distance of 36 miles, for electrical operation. A. J. Earling, of Chicago, Ill., is president.

TACOMA, WASH.—The city of Tacoma expects to install an ornamental street-lighting system on about 30 blocks. B. W. Collins is superintendent of electrical works.

TENINO, WASH.—The local electric-light plant, owned by Wilbur B. Foshay, Milliard Lemon and others, has been taken over by the Northwest El. & Wtr. Co., of Seattle. The new owners, it is said, contemplate extensive improvements.

WENATCHEE, WASH.—The City Council has awarded the contract for installing cluster lamps on Wenatchee Avenue to the Western El. Co., of Seattle, at $3,495.

PORTLAND, ORE.—The Sunnyside Improvement Association has petitioned the City Commissioners for a better street-lighting system in the Sunnyside District.

SANDY, ORE.—Application has been made to the Council by McCormick & Botkin for a franchise to erect transmission lines through Sandy from their proposed power plant on Cedar Creek.

THE DALLES, ORE.—Secretary Lane of the Department of the Interior, at Washington, D. C., has approved an expenditure of $15,000 for an investigation of an interstate water-power project near The Dalles. The State has already appropriated the same amount for this purpose. The proposed project is on the Columbia River. Preliminary surveys indicate the feasibility of a large power development and, in addition, the irrigation of a large tract of land in the Columbia Valley. Investigations will be made by a joint board, consisting of representatives of the Department of the Interior, engineers of the army and the State of Oregon.

HAILEY, IDAHO.—The Rockwell-White Pwr. Co. is contemplating extensions to its distribution lines in Hailey.

PHOENIX, ARIZ.—The City Council has decided to call a special election, to be held Nov. 26, to vote on the proposition to issue $275,000 in bonds for public improvements, of which $25,000 will be used for electric-lighting.

PITKIN, COL.—The Rocky Mountain Devel. Co., with headquarters in Pitkin, has secured all the rights, titles and easements from the State of Colorado, the Forestry Department, the Departments of the Interior and Agriculture, in Washington, to the Roaring Fork of the Grand River and Difficult Creek, in the Sopris forest reserve, for power development. The company proposes to build a hydroelectric plant and transmit electricity to Pueblo, Colorado Springs, Denver and other Colorado cities. It is estimated that from 15,000 hp to 60,000 hp is available. The directors of the company are: William J. Orange, secretary; George S. Foster, Harry A. House and R. M. Stetson, all of Pueblo.

Canada

CALGARY, ALTA.—Tenders will be received by the Bowness Improvement Co., 202 Eighth Avenue West, Calgary, until Dec. 31, for machinery and equipment as follows: (L) One 200-kw traction motor generator; (M) one four-panel switchboard; (N) one 250-kva generator; (O) one vertical, single-acting, multi-cylinder gas engine. Plans and specifications may be obtained from T. L. Turnbull, consulting engineer, 202 Eighth Avenue West, Calgary.

FERNIE, B. C.—The city of Fernie expects to purchase within the next seven months an automatic voltage regulator for four-wire, two-phase, 60-cycle, 2400-volt current for two machines (150-kw each); S. K. C. system, one switchboard wattmeter, poles and wires for construction of 3 miles of distribution lines, 100 5-amp and 10-amp, 110-volt, 60-cycle, single-phase, two-wire meters. James E. Finn is superintendent of municipal electric plant.

WINNIPEG, MAN.—Tenders will be received by the Board of Control until Dec. 11 for a year's supply of direct-current and alternating-current electric induction meters. Specifications, etc., may be obtained at the office of J. G. Glasco, 54 King Street, Winnipeg, Man.

WINNIPEG, MAN.—At the coming municipal elections a by-law will be submitted to the ratepayers asking an appropriation of $1,000,000 for extensions to the municipal light and power system. Of this amount $500,000 will be needed for the new transmission line. Tenders for the proposed transmission line will not be called before spring, but contractors will soon be asked for proposals for piling and other work in connection with the preparation of right-of-way. This tower line will be carried along the right-of-way of the present 60,000-volt line, which is about 75 miles long, and will carry two 110,000-volt lines with suspension-type insulators. The type of towers has not yet been decided upon.

BROCKVILLE, ONT.—The Electric Light Commissioners expect to erect within the next two months a boiler room and to purchase within the next 30 days two water-tube boilers (300 hp each), with stokers, a motor-driven water-works pump having a capacity of 3,000,000 U. S. gal. per 24 hours, complete with motor, switchboards, etc. E. J. Philips is manager.

PORT ARTHUR, ONT.—The electrical department of the municipal electric light, power, railway and telephone system expects to erect 3 miles of transmission line to pumping station, 25,000-volts stepped down to 2200 volts. The line will be erected on cedar poles with No. 2 aluminum wire for 600 hp. A similar line has just been completed to the Canadian Northern Railroad elevator and the Dominion elevator for 1500 hp. Richard Fox is superintendent of electrical department.

TORONTO, ONT.—If the provincial government gives its consent work will soon be started on the hydroelectric project at Eugenia Falls, which when completed will furnish electricity in Huron, Bruce and Grey County municipalities. The Hydro-Electric Commission has contracts with the municipalities of Owen Sound, Chatsworth, Meaford, Flesherton, Thornbury and Markdale. The cost of the scheme embracing the municipalities, including the transmission lines, is estimated at about $400,000, while linking up Collingwood will bring the total cost to about $500,000.

CHARLOTTETOWN, P. E. I.—A new company, known as the Charlottetown El. Co., has been organized to take over the property of the Charlottetown Lt. & Pwr. Co. The City Council recently made an offer of $96,000 for the entire plant, which was voted down by the ratepayers.

MURRAY BAY, QUE.—The Labrador El. & Pulp Co., Ltd., of Murray Bay, expects to purchase within the next six months one 250-hp engine to operate an alternating-current generator for lighting the city; also within the next four months to purchase two transformers (10,000 kw) and 50 cedar poles for repairing 20 miles of lines. J. O. Duguvay is manager.

SHAWINIGAN FALLS, QUE.—The St. Maurice Lt. & Pwr. Co., of Shawinigan Falls, expects to erect within the next six months about 15 miles of 50,000-volt transmission line from Nicolet toward Pierreville. Joseph G. Telmosse is superintendent.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Dec. 3 for switchboards, electrical cable, conduit and fittings and miscellaneous electrical apparatus and structural steel, under circular (No. 810). Bids also will be received until Dec. 4 for galvanized steel or iron steel cable, steel wire, galvanized ridge roll rivets, taps, cable clips, brass tubing,

gaskets, magnesia pipe covering, magnesia boiler lagging, etc., under circular (No. 808). Blanks and general information relating to these circulars may be obtained from the above office, or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is purchasing officer.

New Incorporations

SWANTON, OHIO.—The Swanton Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by Abner D. Baker, Fred E. Pilliod, T. J. Pilliod, Robert S. Graves and A. Q. Price.

HARRISBURG, PA.—Charters for nine electric companies have been granted by the State Department to operate in eastern Pennsylvania. Joseph P. Murray, W. F. Callaghan and F. Stanley Saurman, of Philadelphia, took out charters for the Hatfield, Souderton and Silverdale El. Lt. & Pwr. Cos., each capitalized at $5,000, to operate in the boroughs named. Charters were granted to H. A. Mendenhall, of Toughkenamon; S. Pusey, of West Grove, and H. D. Anderson, of Pittsburgh, for six companies to operate from Kennett Square. Each company is capitalized at $5,000, and they will serve in the Chester County districts as follows: West Grove Borough, New Grove Township, London Grove Township, Kennett Township, East Marlborough Township and Avondale Borough, each company taking the name of the district it operates in.

HONEY CREEK, WIS.—The Honey Creek El. Co. has been granted a charter with a capital stock of $4,000. The incorporators are: H. B. Miller, E. F. Healey and L. L. McDonald.

MONTREAL, QUE.—The Quebec Devel. Co. has been incorporated with a capital stock of $2,500,000 for the purpose of acquiring water rights, the erection of electric systems and generating plants, building underground subways and manufacturing electrical machinery. The main office of the company is in Montreal.

SALABERRY DE VALLEYFIELD, QUE.—The Valleyfield Wtr. Pwr. Co. has been incorporated with a capital stock of $1,000,000 by N. A. Ostiguy, J. Lowe and A. Cossette.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 11, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,077,972. RELAY FOR TWO-WIRE NOTCHING SYSTEMS; E. R. Carichoff, Schenectady, N. Y. App. filed Aug. 9, 1911. For controlling successively oprcrated switches such as are used for controlling railway motors.

1,078,013. ELECTRIC HORN; C. F. Townsan, Mitchell, S. D. App. filed Feb. 25, 1913. A tapper bar strikes a ball seated in a hole in the diaphragm.

1,078,035. AUTOMATIC ELECTRIC DISPATCH SYSTEM; J. Deschamps, Paris, France. App. filed Jan. 26, 1912. A car in one section of an electric railway modifies the circuit conditions for a car in another section.

1,078,058. TIMING DEVICE; C. R. Moore, Lafayette, Ind. App. filed Nov. 27, 1912. Combination of magnets for maintaining the oscillation of a timing pendulum.

1,078,063. THERMOSTATIC FIRE ALARM; J. Rancourt, Quebec, Canada. App. filed May 3, 1913. Pivoted circuit-closing arm disposed to be engaged and operated by the swinging indicator needle of a thermostat.

1,078,076. POTENTIAL REGULATOR; W. Welsch, Berlin, Germany. App. filed Jan. 5, 1912. Transformer winding and core divided so that groups of windings having independent magnetic circuits are cut into or out of circuit, generally alternately, as the switching device is moved.

1,078,106. HARMONIC RELAY; K. B. Miller, Chicago, Ill. App. filed July 17, 1909. For selective signaling on multi-party telephone lines.

1,078,127. RAILWAY SIGNAL; J. P. Coleman, New York, N. Y. App. filed April 17, 1909. Semaphore system.

1,078,131. PROTECTIVE DEVICE FOR STREET CARS; E. E. F. Creighton, Schenectady, N. Y. App. filed June 7, 1912. Automatic system of charging the electrolytic cells which form the discharge path.

1,078,133. PNEUMATIC ELECTRIC TRACKER BAR FOR MUSICAL INSTRUMENTS; C. W. Dorricott, Philadelphia, Pa. App. filed Nov. 4, 1912. Contacts are housed to protect them from the dust and lint carried by the music roll.

1,078,141. OIL-COOLED TRANSFORMER; F. C. Green, Pittsfield, Mass. App. filed Jan. 24, 1910. Transformer tank, cooler and circulating pump all united in one structure.

1,078,172. ELECTRIC CONTACT AND INDICATOR; R. T. Smith, Reno, Nev. App. filed Dec. 18, 1912. The visual indicating lamp, when screwed into its socket, closes the circuit to the electric heater, iron or other device.

1,078,174. BRUSH HOLDER FOR DYNAMOS; C. H. Smoot, Chicago, Ill. App. filed Dec. 14, 1906. For high-speed turbo-generators; combination of brush of slight inertia and a weight of relatively great inertia exerting pressure on the brush through a stiff spring.

1,078,179. ELECTRIC GENERATING SYSTEM; H. H. Wait, Chicago, Ill. App. filed Oct. 7, 1909. Provides, in addition to the shunt and compensating series windings, a compound series winding so connected that as the load on one machine increases the field strength of the other machine is increased.

1,078,181. BOX FOR ELECTRIC CONDUITS; H. J. White, San Francisco, Cal. App. filed Oct. 6, 1910. An inner perforate shell and an outer imperforate shell which may be reamed out in register with any of the perforations in the thicker inner shell.

1,078,194. BRUSH HOLDER FOR ELECTRIC MOTORS OR GENERATORS; E. A. Halbleib, Rochester, N. Y. App. filed Nov. 29, 1912. Special method of securing the supporting rods on which the brush holders are pivoted.

1,078,195. ELECTRIC SWITCH; E. A. Halbleib, Rochester, N. Y. App. filed, Jan. 20, 1913. "Kick switch" for automobiles.

1,078,201. SUPPORT FOR TELEGRAPH AND TELEPHONE WIRES; H. L. Hoybook, Tyler, Tex. App. filed Feb. 1, 1912. Annular supporting member and insulators seated therein and slotted to receive the wires.

1,078,206. ELECTRIC METER; J. Mayer, Seattle, Wash. App. filed May 13, 1912. Records upon separate dials the consumption of current during specific periods of time.

1,078,218. TROLLEY; E. Reddick and J. P. Noel, Hackensack, N. J. App. filed April 11, 1912. Corrugated cam enlargements on the outer surfaces of the wheel flanges.

1,078,225. ELECTRICAL WELDING OF SHEET METAL; E. Thomson, Swampscott, Mass. App. filed Oct. 21, 1909. String of metal contact pieces for localizing and locating the spot welds.

1,078,226. METHOD OF WELDING; R. D. Thomson, Swampscott, Mass. App. filed May 12, 1911. Subjects one piece to end pressure and heating current to form a welding projection on one side thereof and welds the end of a second piece to the said projection.

1,078,229. SIGNALING SYSTEM; H. G. Webster, Chicago, Ill. App. filed Sept. 4, 1906. Receiving devices less in number that the circuits; prevents false signal indications when signals are transmitted over separate circuits simultaneously. (Forty-seven claims.)

1,078,274. ELECTRIC CLOCK; H. Gillette, Chicago, Ill. App. filed Oct. 21, 1912. Economizes current by opening the circuit instantaneously after each closure thereof by the master clock.

1,078,286. GAS ENGINE; L. Illmer, Jr., Cincinnati, Ohio. App. filed April 4, 1907. Toggle linkage for actuating the poppet valve of a two-stroke-cycle gas engine.

1,078,290. ELECTRIC RIVET FURNACE; W. S. Johnson and J. W. Sheffer, Berwick, Pa. App. filed Jan. 27, 1913. Electrode formed with a chamber to receive the head of a rivet and a movable electrode to engage the end of the rivet.

1,078,343. THERAPEUTIC APPARATUS; A. Fumo, New York, N. Y. App. filed April 15, 1913. Circuit is completed through the tonic and the body of the patient as the tonic is poured over the parts treated.

1,078,368. LINE INSULATOR; O. C. Meusebach, San Antonio, Tex. App. filed Dec. 24, 1912. Insulator pins project downwardly from within sheet-metal casing which forms the cross-arm.

1,078,404. ELECTRIC SWITCH; C. E. Avery, Jersey City, N. J. App. filed April 15, 1913. Push-button construction for door-bell switches.

1,078,410. ALARM, SIGNALING AND CONTROLLING DEVICE; E. H. Bock, Berlin, Germany. App. filed Oct. 17, 1911. A light needle dependent from an elastically suspended weight, by its vibrations, serves to close a circuit.

1,078,425. LOCK; A. S. Franks, New York, N. Y. App. filed Aug. 6, 1913. Can be operated from the interior at any time, but can be operated from the exterior by a magnet only.

1,078,439. REPULSION-MOTOR-CONTROL SYSTEM; C. B. Hoffmann, Cincinnati, Ohio. App. filed June 19, 1911. For alternating-current insulated-block signaling systems.

1,078,458. FUSE PLUG; H. T. Paiste, Philadelphia, Pa. App. filed Dec. 6, 1911. Has a fuse-carrying capsule which is readily insertible within the fuse body.

1,078,463. MINE-SHOT-FIRING SYSTEM; G. I. Rawson, St. Louis, Mo. App. filed May 4, 1909. The apparatus for successively firing the charges is located in the mine adjacent to the chambers in which the shots are to be fired and is controlled from the surface.

1,078,472. FUSE PLUG; G. B. Thomas, Bridgeport, Conn. App. filed Nov. 25, 1912. Cap of the plug is crimped to interlock with ribs on the body of the plug and has its lower edge turned under a peripheral flange on the body to prevent separation.

1,078,476. BURGLAR ALARM; O. Wiggers, Hooper, Utah. App. filed March 8, 1913. Circuit-controlling plunger passes through an opening in the wall of the safe into engagement with a box or other article inside the safe.

1,078,489. TROLLEY GUARD; P. Dragon, C. D. George and R. J. Palmerio, Philadelphia, Pa. App. filed March 9, 1912. Parallel-sided guard pivoted on axle of the trolley wheel and extending rearwardly therefrom.

1,078,523. KNIFE-SWITCH BLADE; A. K. Sutherland, Plainville, Conn. App. filed Jan. 10, 1913. An attaching piece is swaged into recesses in the end of the switch blade.

1,078,550. BURGLAR ALARM; E. Ogle, Dallas, Tex. App. filed April 18, 1912. A resilient member on the window sash bears against elongated contact strips seated in the channels which guide the sash.

1,078,586. SOCKET FOR ELECTRIC LAMPS; G. C. Knauff, Chicago, Ill. App. filed April 23, 1912. Spring-pressed contacts for socket which receives the lamp in one end and the terminal plug in the other end.

1,078,595. PNEUMATIC GOVERNOR; B. S. Aikman, Chicago, Ill. App. filed July 31, 1911. Governing unit for maintaining constant pressure in an air brake or like fluid pressure system.

1,078,597. HOLDER FOR HIGH-TENSION ELECTRODES; A. R. Darling, Indianapolis, Ind. App. filed Jan. 6, 1913. Inner and outer members separated by an air space with a connecting socket in the inner member.

13,643 (reissue). ELECTROLYTIC DEVICE FOR GENERATING OXYGEN AND HYDROGEN; R. Moritz, Wasquehal, France. (Original patent No. 981,102, issued Jan. 10, 1911.) Prevents possibility of the admixture of the two gases in the apparatus.